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# AERO DIGEST

INCLUDING AVIATION ENGINEERING





## The Second Annual Digest of Aircraft & Engine Machinery

THE TAYLOR CUB
as a land plane
and seaplane

JANUARY 1937
35 Cents

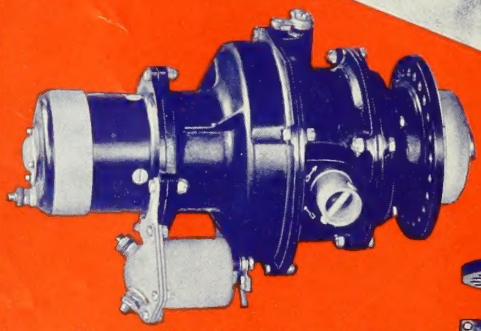


THROUGH twenty years' experience in the design, development and manufacture of aircraft engine starting equipment, ECLIPSE AVIATION CORPORATION has anticipated and pioneered in fulfilling the starter requirements of engine manufacture throughout the world for commercial, military and private applications.

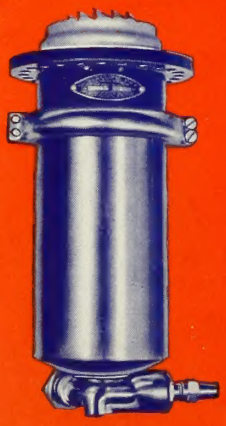
Many varied installation, operation and service conditions have been fully recognized, and proper starting equipment has been made available to meet such needs. With this well founded knowledge, ECLIPSE AVIATION CORPORATION offers the following basic type starters, operating from various power sources, to serve specific purposes.

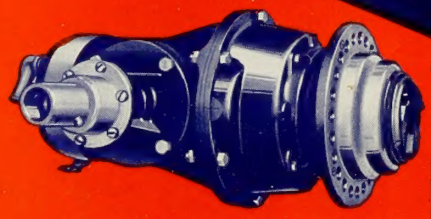
| POWER SOURCE | STARTER TYPE |
|---|---|
| Manual . . . . . | (a) Inertia (Manual only)<br>(b) Hand Turning Gear |
| Electricity (DC-12 or 24 volt) . . . . | (a) Inertia (Combination Manual and Electric)<br>(b) Direct Cranking Electric |
| Air Pressure . . . . | (a) Air Injection |
| Cartridge (Powder) | (a) Combustion |
| Electricity (AC-110 volt—800 cycle) | (a) Inertia (Combination Manual and Electric)<br>(b) Direct Cranking Electric |

ECLIPSE AVIATION CORPORATION
EAST ORANGE, N. J.
*(Subsidiary of Bendix Aviation Corporation)*



*Above: Eclipse Series 11 Combination Hand and Electric Inertia Starter for 12 or 24 volt operation available with complete remote controlled acceleration and engaging means.*





*Above: Eclipse Type E-160 Direct Cranking Electric Starter with integral hand cranking gear, for 12 or 24 volt operation and providing push button remote engine starting control.*

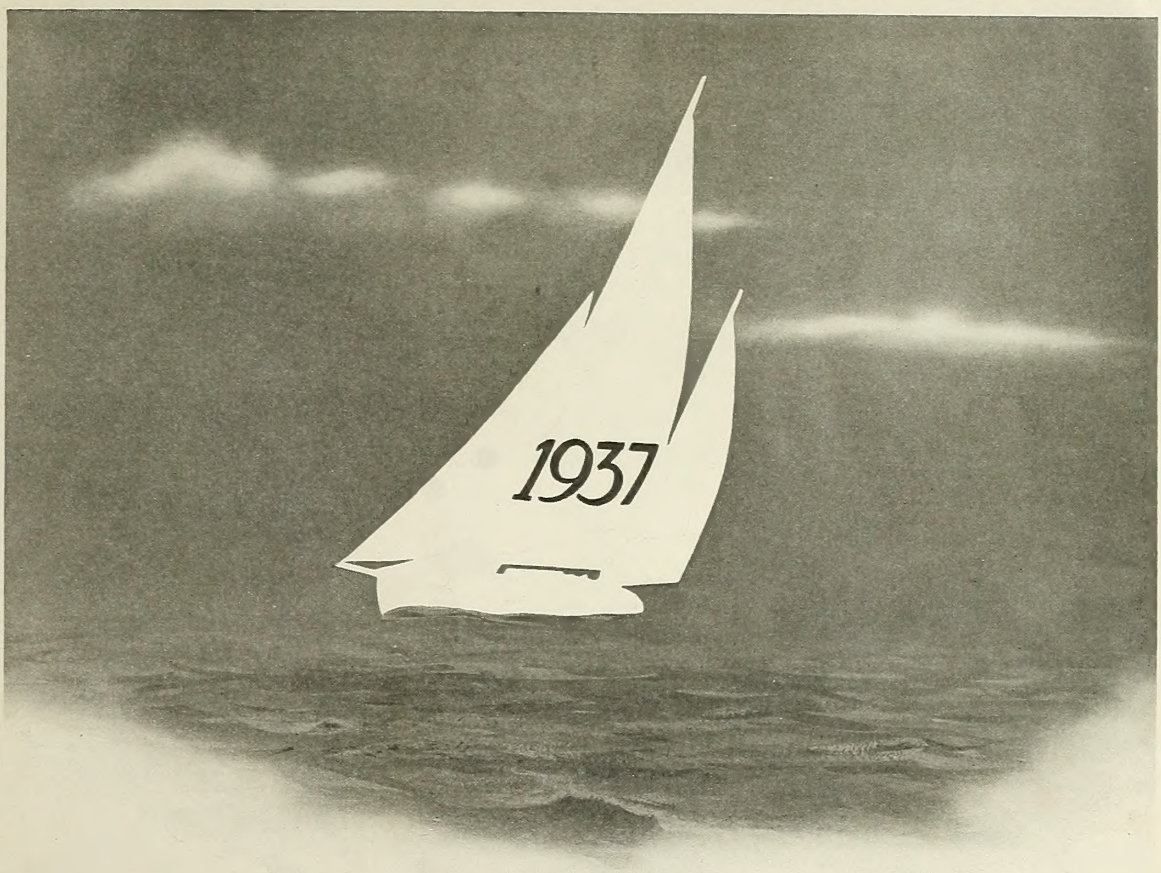
*Above: Eclipse Combustion Starter operating from power developed by remotely controlled igniting of concentrated energy in cartridge form.*

**Visit the Eclipse Exhibit at the NATIONAL AIR SHOW**
New York, Jan. 28 to Feb. 6
Booths 128 to 132



AERO DIGEST, JANUARY, 1937
*Volume 30* *Number 1*

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*May you sail with the Good Ship 1937 to the Port of Prosperity and Happiness*

**RESOLVE this New Year to use only genuine FLIGHTEX. There are other fabrics, but only *ONE* FLIGHTEX FABRIC—the specially designed Grade A airplane covering. That is why FLIGHTEX is the choice of discriminating aircraft manufacturers.**

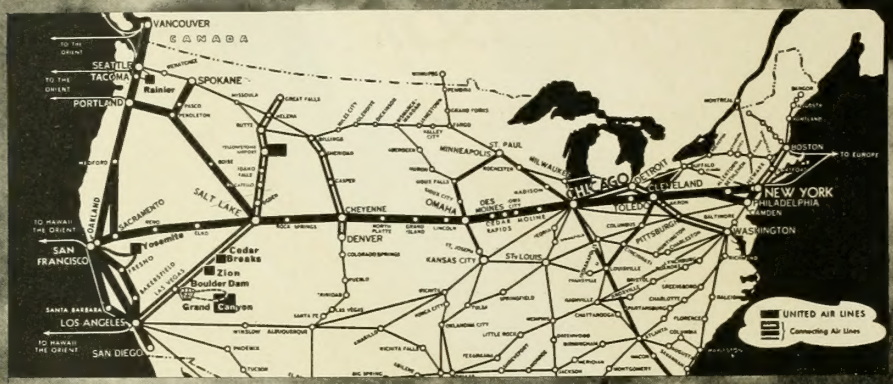
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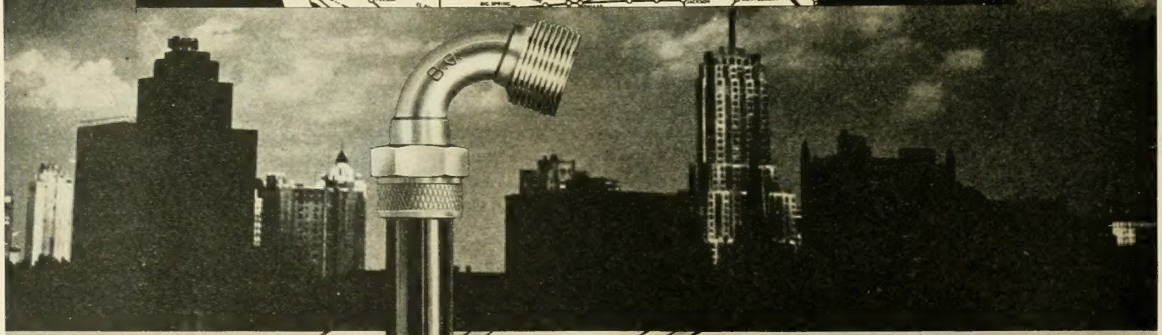
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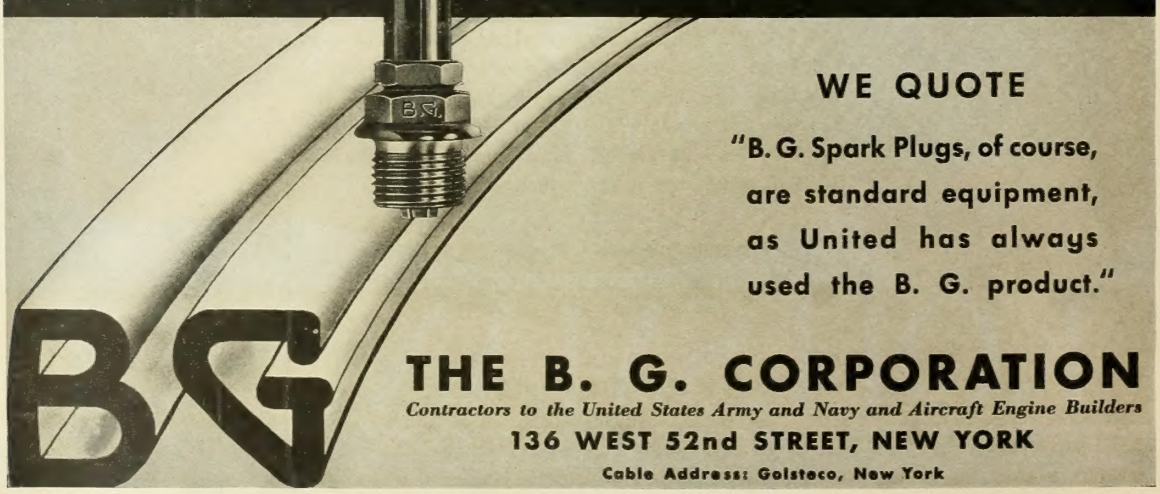
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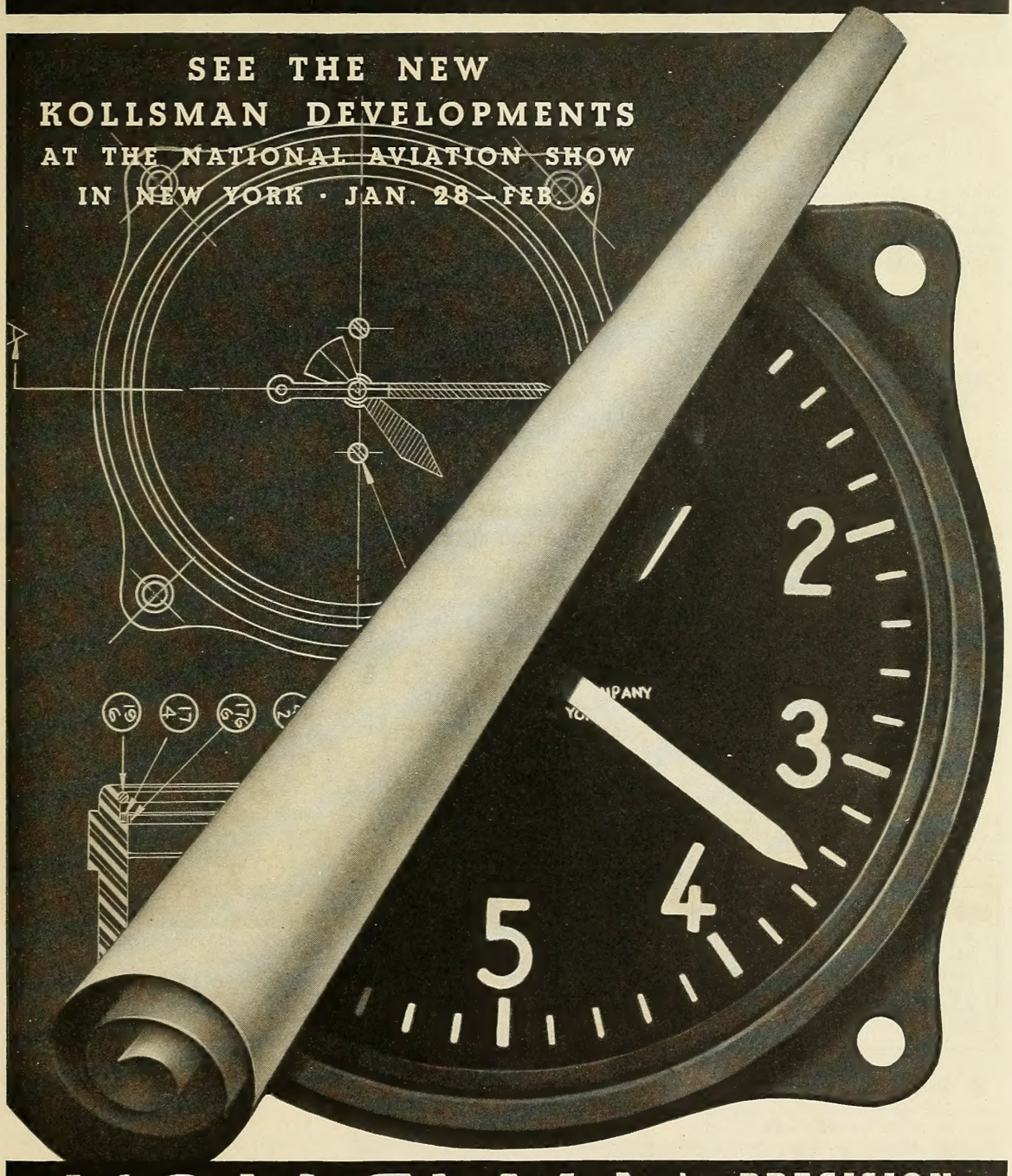
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*Contractors to the United States Army and Navy and Aircraft Engine Builders*

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# AT THE SHOW

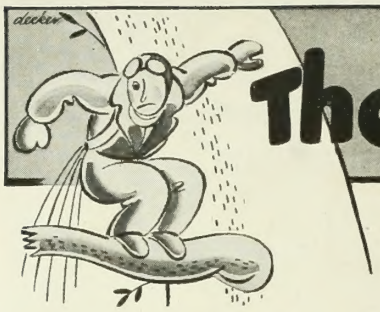



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# The Birdmen's Perch



**Our New Year's resolutions for The Perch are: (1) bigger whoppers, (2) funnier gossip, (3) crazier squibs. This is a first-class platform, especially since it's up to you fellows to deliver the news. Why don't you sit down right now and send us a few tales out of school? Address the scandal to:**

MAJOR AL WILLIAMS, *Manager, Aviation Department,* Gulf Aviation Products, Gulf Building, Pittsburgh, Pa.

## A LETTER FROM AUSTRALIA



"I would like very much to correspond with American aviation enthusiasts. If you could mention this fact in your page, I should be very pleased.

"I would like correspondence with either sex, so long as the persons are not more than twenty years of age.

"My name is Douglas Chambers. The address, Burbanks, Via Coolgardie, West Australia.

"I sincerely hope this will not be too much trouble to you. I think you ought to start up a pen friends club. Don't you think so, too?"


**WE POINT WITH GULFPRIDE**

**We learn that Eastern Air Lines has recently completed its 32-millionth passenger mile using *Gulfpride Oil.* Two bouquets for this swell record: one to Eastern, the other to Gulfpride!**


## CHARLIE'S BEEN FOUND

Sometime ago in your column you wondered as to the whereabouts of Charles Augustus Macatee 3rd, who used to fly in these parts.

Well, this bird has finally settled down as a co-pilot with American Airlines. He is assigned to the New York-Chicago via Washington run, and twice a week comes through and leers at us from the pilot's compartment of a Douglas.

Mr. Macatee has also managed to wangle himself a commission as an Ensign in the Naval Reserve, and last summer spent two weeks at Cape May on active duty, scaring the natives and summer visitors to death.

—JAY SCOTT, Washington, D. C.

## PENNSYLVANIA-CENTRAL LANDS 230 POUNDER

R. L. (Bud) Baker has been named Chief Pilot for the recently formed Pennsylvania Central Airlines Corporation.



He has 50 pilots under him, and they love it. Personally, it distresses us to think of *any* pilot being under him, for Bud weighs around 230 pounds.

Incidentally, both Pennsylvania and Central Airlines have long been enthusiastic users of Gulf Aviation Gas—and the new combine plans to continue this sensible procedure.

## MATERNITY MAN

An Eskimo woman in an isolated Alaskan village was about to have a baby. The Indian Service nurse wired for a plane to rush the native woman to the Fairbank's hospital. Soon the ship was whirring low over the settlement.

The nurse pointed out the window and said to her patient, "Look, there's the airplane that is going to take you to the hospital."

Maybe she thought it was the stork, but anyway the expectant mother, frightened half to death, had her baby then and there. Special Delivery, so to speak.

— K. B.

## THIS MONTH'S WHOPPER

A pilot who combines flying and fishing tells this story:

"Last summer I flew up to a mountain lake, sat down, got on one of the pontoons and began casting. No luck. Meanwhile an old gent in an equally old boat was catching plenty of good fish.

"Inquiring what bait he was using, he replied, 'Frawgs.'

"So I beached my ship and went looking for frawgs. Chased several small ones with no success. Heard a thrashing in the underbrush, and on investigation discovered a medium-sized moccasin trying to swallow an oversized frog.

"Rushed back to the ship to get a weapon to kill the snake. I grabbed my oil can (filled with Gulf Aviation Gas for priming) deciding to 'gas' the reptile. Ran back and knocked the snake silly with a small stick, the frog slipping from its mouth.



"Put a foot on the frog to save him for bait, at the same time giving Mr. Moccasin several squirts of Gulf Aviation Gas down his throat.

"Took my frog and returned to my pastime. No luck, but did a beautiful job of drowsing in the warm sun. Was awakened by a gentle tapping on my thigh, and looking down, there was Mr. Moccasin with a very pleased expression on his face and another frog in his mouth."

—"Deepwater Jim" Melton


**Gulf Oil Corporation and Gulf Refining Company . . . makers of**

**GULF AVIATION PRODUCTS**

# Take the DIRECT ROUTE

from **PREPARATORY SCHOOL** to **PARKS AIR COLLEGE**



## A POSITION IN COMMERCIAL AVIATION

**Parks Graduates are being placed in aviation before graduation**

Eleven men were graduated in the 1936 Spring term class at Parks Air College. **All were placed in aviation before graduation.**

Twenty-seven men were graduated in the Summer term class. **All were placed in aviation before graduation.**

Twenty-seven men were graduated in the Fall term class. **All but one were placed before graduation.**

Parks training is your direct route to commercial aviation's opportunities.

## "PRE-VIEW"

Look at Parks Air College through the eyes of some of aviation's leading executives . . . men who have been building aviation to giant proportions . . . men who know Parks Air College and Parks graduates.

C. R. Smith, President of American Airlines, Inc., said:
"You are doing a fine job at Parks Air College."

H. D. Ingalls, Superintendent of Maintenance of American Airlines, Inc., said:
"I'm for Parks graduates. They know their stuff."

A. Francis Arcier, Chief Engineer, the Waco Aircraft Company, writing to President Parks, said:
"We would greatly like to fill our vacancy from the ranks of your graduates, as we have a lively appreciation of the high standard to which your graduates must measure up."

Carl B. Squier, Vice President of Lockheed Aircraft Corporation, said:
"Your graduates leave Parks fully prepared to fill their niche in the industry."

G. W. Vaughan, President of the Wright Aeronautical Corporation, said:
"You have a wonderful institution here."

Donald Frye, Personnel Director of Consolidated Aircraft Corporation, addressing the Parks Aero Club, said:
"We will have a job for any graduate of Parks Air College who comes to us with a letter of introduction from your President."

Jack Frye, President of Transcontinental and Western Air, wrote from Kansas City:
"We appreciate the good work you are doing over there."

Paul E. Richter, Vice President of Transcontinental and Western Air, in Charge of Operations, said:
"You can be sure that when we put on more men we will get in touch with you."

Many more such expressions could be quoted.

These executives know the value of adequately trained personnel so you can be sure they will be interested in you after your graduation from Parks Air College.

Parks Air College is your direct route from Preparatory School to a position in commercial aviation. It is the School that offers you a college education majoring in aviation.

All training is of college and professional school rank. It is thorough. It is intensive. It is interesting because it is practical.

The amount of training you receive is equal to or greater than that required for graduation from the usual 4-year curriculum.

Because the class and laboratory schedules are well filled, you can complete your training in a period of 96 weeks . . . two calendar years. The next two years, instead of spending, you will use earning and advancing in the aviation industry.

The four major courses lead to the Bachelor of Science degree. They provide the training background necessary for advancement to responsible positions in Professional Piloting, Aviation Operations, Aviation Mechanics and Aeronautical Engineering.

## SEND FOR THE FREE CATALOG

Since you are considering a career in aviation you owe it to yourself, first of all, to secure complete information about the training offered you by Parks Air College. The catalog contains this information. Your request will bring it to you, and it is free.

The coupon is for your convenience. Clip it, fill and mail *now!*




AN AIR VIEW OF PARKS AIR COLLEGE, "THE TRAINING DIVISION OF COMMERCIAL AVIATION."
THE ENTIRE SCHOOL PLANT IS USED EXCLUSIVELY FOR AVIATION TRAINING PURPOSES

**See us at the National Aviation Show, Grand Central Palace, New York, Jan. 28th to Feb. 6th. We will be in booth 219 on the Mezzanine Floor.**

●

*Spring Term March 29*
*Summer Term July 5*

**PARKS AIR COLLEGE**
WORLD'S LARGEST COMMERCIAL AVIATION SCHOOL

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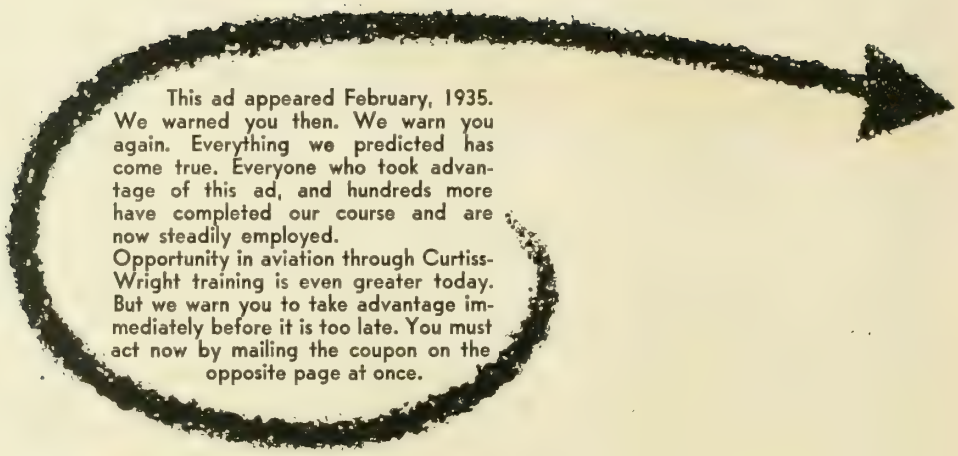
Please mail me, without charge, the Parks Air College catalog.

Name_____ Age_____

Address _____

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Four major courses, each leading to the Bachelor of Science degree are offered:
- Professional Flight and Executive
- Aviation Operations and Executive
- Master Mechanics' Flight
- Aeronautical Engineering



This ad appeared February, 1935. We warned you then. We warn you again. Everything we predicted has come true. Everyone who took advantage of this ad, and hundreds more have completed our course and are now steadily employed.

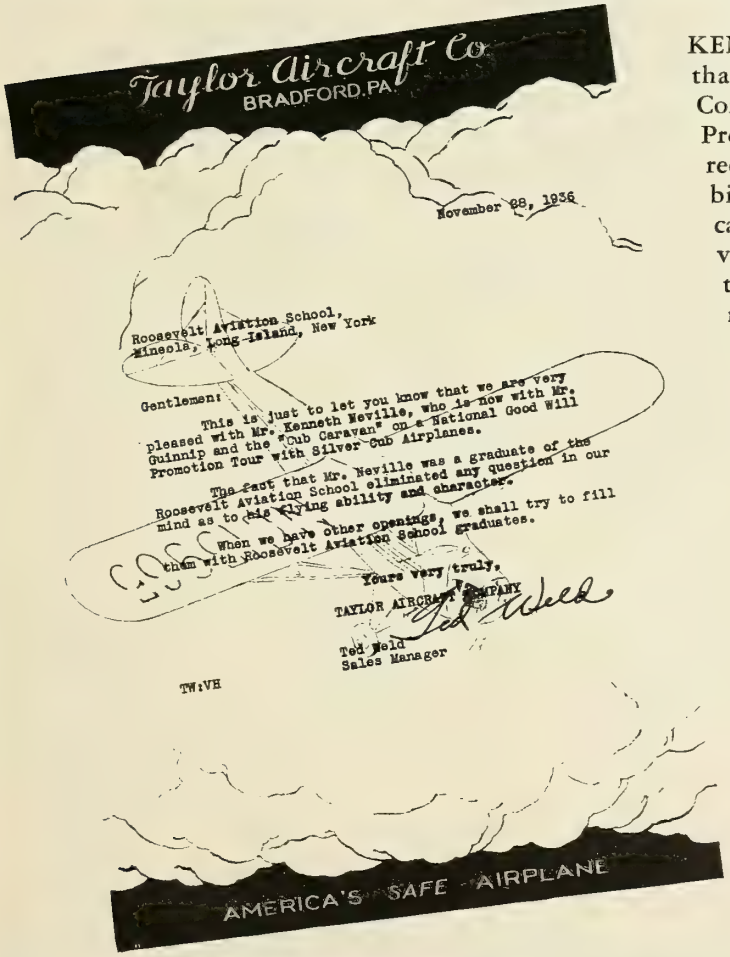
Opportunity in aviation through Curtiss-Wright training is even greater today. But we warn you to take advantage immediately before it is too late. You must act now by mailing the coupon on the opposite page at once.

# *"When we have other openings, we shall try to fill them with Roosevelt Aviation School graduates"*





The "Cub Caravan" National Good Will Promotion Tour. Left to right: Ellsworth Salisbury, Art Kraft, Ken Guinnip and Kenneth Neville (shown in close-up) Roosevelt Aviation School Master Mechanics and Transport Pilot graduate.



Taylor Aircraft Co
BRADFORD, PA.

November 28, 1936

Roosevelt Aviation School,
Mineola, Long Island, New York

Gentlemen:

This is just to let you know that we are very pleased with Mr. Kenneth Neville, who is now with Mr. Guinnip and the "Cub Caravan" on a National Good Will Promotion Tour with Silver Cub Airplanes.

The fact that Mr. Neville was a graduate of the Roosevelt Aviation School eliminated any question in our mind as to his flying ability and character.

When we have other openings, we shall try to fill them with Roosevelt Aviation School graduates.

Yours very truly,
TAYLOR AIRCRAFT COMPANY
Ted Weld
Ted Weld
Sales Manager

TW:VH

AMERICA'S SAFE AIRPLANE

KENNETH NEVILLE writes: "The fact that I am with The Taylor Aircraft Company on its National Good Will Promotion Tour, ought to be sufficient recommendation to induce other ambitious young men, interested in a career in aviation, to enroll at Roosevelt Aviation School. Without the training I received there, I would not now be in the aviation business, nor would I be enjoying the thrills of this caravan."

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*"Start Right at Roosevelt"*

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Without obligating me, send details of course checked below:

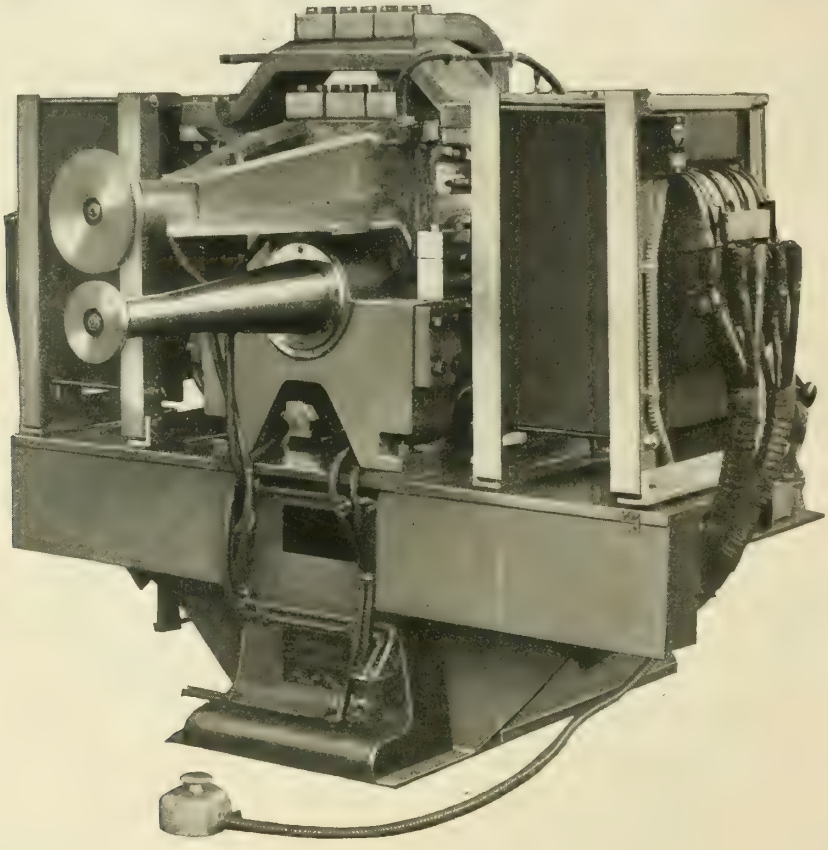
Amateur Pilot_____ Private Pilot_____ Limited Commercial Pilot_____ Transport Pilot_____ Elementary Airplane and Engine Mechanics_____ Master Airplane and Engine Mechanics_____ Combination Flight-Mechanics_____

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Illustration shows one of their latest developments in seam welders for producing aluminum gas tanks for aeroplanes.

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Machine has two 200-KVA welding transformers.

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SPECIAL TRAVEL ALLOWANCE AND PART TIME WORK OFFER WITH EACH COURSE.

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***15 Ships of all types***

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**SPECIAL MENTION**

During the past few months we have added $26,000 worth of new equipment, betterments, another dormitory, new motors and another fully equipped cross-country cabin ship, rebuilt by the students of the school. A very fine special job.

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## AVIATION SCHOOL AND AIR COLLEGE

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Please send me your catalog. I am interested in

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Frank Hawks
COMMANDER






FLYERS all over the world are enthusiastic about the low initial cost and small operating and maintenance expense of the Silver Cub. Like more than a thousand others, America's Speed King cannot praise his Silver Cub too highly:

"Since taking delivery of my Cub I have been flying it a great deal", says Commander Frank Hawks. "I am very much impressed with the ship. Naturally, its low initial cost is noteworthy, but its small operation cost is of more importance.

"I find the Cub very easy to fly, with an easy take off, remarkably low landing speed and excellent all around flying characteristics. In my estimation it is the most dependable, safe and economical airplane in its field of competition on the market."

SEE THE NEW CUB AT THE NATIONAL AVIATION SHOW, GRAND CENTRAL PALACE, NEW YORK CITY

*The New Silver*

# CUB

**World's Fastest Selling Airplane**

Think of it! Now you can own a Silver Cub for only $1270 (F. A. F. Bradford, Pa.) — practically the same cost as a medium-priced motor car. However, don't delay! Daily mounting costs of labor and materials make the Silver Cub price subject to change without notice. So avail yourself of aviation's biggest value now—today! On the easy payment plan you pay only $425 down, with unusually low monthly installments. Don't delay! Buy now —and save!

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**FREE!** **Handsome Illustrated Folder**
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TAYLOR AIRCRAFT COMPANY
17 D Street, Bradford, Pa.

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Please send me your free illustrated folder and name of my nearest Cub dealer.

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GRUMMAN fighters are built
To the practised eye this view of GRUMMAN assemblies tells a bigger story than the camera can record. For beyond the range and realm of the lens extends one of the most modern aircraft factories in the world—adequately meeting the most exacting manufacturing demands of Today, and ready for those of Tomorrow.
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Hundreds of positions in the aircraft industry are open right now! Opportunities for young men to make a success in aviation are far greater today than ever before!

Yet there is only one key that can unlock this situation for you. And that key is — Proper Training.

Without training, you face a hard, uphill fight all the way and your goal is never clear. But with the type of complete, modern training Ryan gives you can anticipate immediate employment after graduation and you will advance, as other Ryan graduates will proudly tell you they have advanced to important positions in their chosen branch of the industry.

Because of the wide scope and variety of every Ryan course you are not restricted in following your natural inclinations, but can choose the course that will make the best of your own qualifications.

Send the coupon today — it is the key that can unlock your entire future for you.

Spring term begins April 5th.



Ryan School of Aeronautics, Dept. AD1
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I am interested in courses checked. Please send additional information:

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| ☐ Transport | $1975 | ☐ Master Mechanic | $ 625 |
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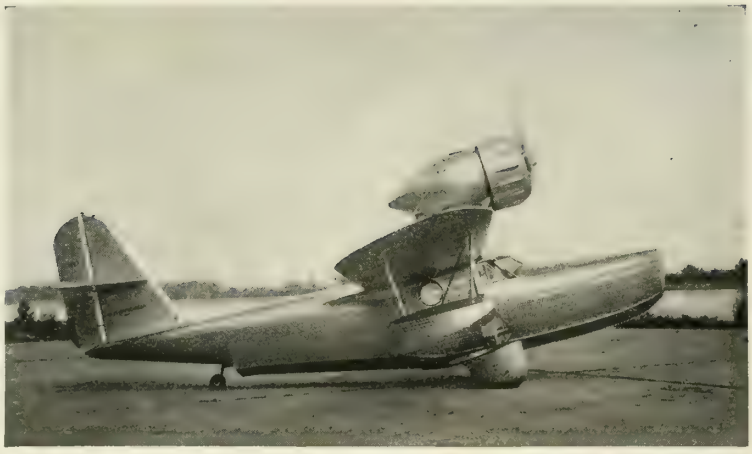
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*Fleetwing stainless steel "Sea Bird," equipped with Plexiglas windshield and sliding side panels*

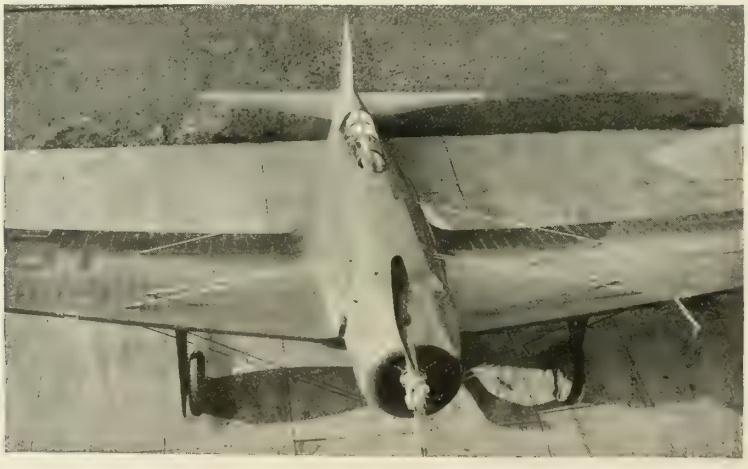
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VOLUME THIRTY NUMBER ONE



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Some of the sixt
displays at the 2
annual exhibition
"Aircraft in Industry
a public showing of t
latest improved devic
and materials to increa
safety, strength and pow
in aviation, as well as
protect the investments
flying and ground equipme







*Kurt Schelling*



This free exhibition spon-
sored by Aero Digest at the
Metals & Plastics Bureau,
3d floor, International
Bldg., Rockefeller Cen-
ter, will continue until
Jan. 15th, from 10 AM
to 6 PM (Saturdays
3 PM) attracting
hundreds of people
daily (See pg. 89)

# The Influence of Air Power upon History

CY CALDWELL

**Only the opening chapter of the world's story of winged warfare has been written. But already sufficient evidence exists to enable the thoughtful to appraise in some measure the influence that air power must exert upon history. It will be an influence as great and as far reaching as that wielded by sea power in the past. Air power will cause huge cities to vanish as congested units, to be rebuilt in hundreds of smaller segments, altering the face of the countryside the world over. It will force the migrations of peoples by the millions; it will alter the course of nations and of empires. In our lifetime it will rule and change the world.**

● In this brief monograph we consider only the influence that air power must exert upon the history of the British Empire, as that history will be written during the next major continental war in which England is involved.

There is no reliable guide to the future other than a careful study of the past, so we limit our consideration to facts, to the lessons of recent history, and to the known capabilities of aircraft already in existence. It is not needful to speculate about the larger and faster multi-engined machines that undoubtedly will come, and which now are in process of construction. Today's warplanes, such as every major power possesses in quantities, can change the course of an empire.

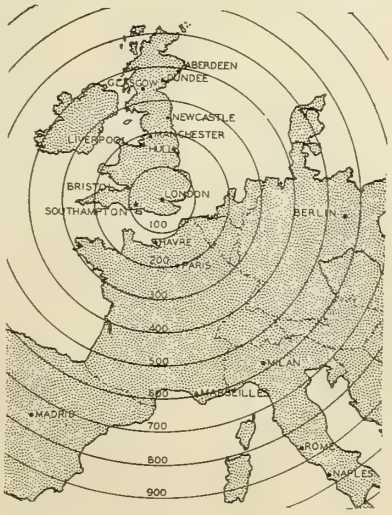
The British Empire as an island-controlled political entity cannot survive the next major war. Air power has doomed England to an immediate expectancy of isolation and starvation. That much is a certainty. Only the fate of the Empire (which is outside the province of this study) is subject for speculation.

To comprehend why the British Empire in its present form and with its present distribution of population cannot survive a major war, it is necessary to consider several apparently unrelated matters which, studied together, present a vivid and startling picture of the almost hopeless position in which air power has placed England. It explains the reason for such feverish preparation for war, especially for air war, by a nation which does not want more territory, and does not want war.

In the coming conflict, England will fight not to conquer, but to live.

Those apparently unrelated matters which, considered in their relations to each other, lead to the conclusion stated are: the area and population of England; the method of supplying that population with foodstuffs and materials for manufacture; the distribution of raw materials and manufactured goods in world commerce; the capability of modern warplanes; the submarine campaign of the war of 1914-'18; and the Italian conquest of Ethiopia in 1936. These diverse matters, grouped for the first time in public print, have been considered at least since the summer of 1936 by the British Government. And our conclusion is based upon that Government's open preparation for war and upon the Government's recent order that food supplies must be greatly increased. What the Government has not told the English people is that no amount of war preparation, no mere storing of food, no matter in what amount, can save England from the impending doom decreed by airpower: world isolation and the almost complete paralysis of the economic life of the nation.

Now let us consider these facts: the area of England and Wales is 58,324 sq. mi.; population had reached 37,750,000 in 1921 *(Encyclopaedia Britannica)* and is about 40,000,000 today (including Scotland, about 45,000,000). In 1926, England's population per sq. mi. was 668—it is more now (this compares to a density of only 38 per sq. mi. in the U. S.). The percentage of population living in towns of over 100,000 inhabitants was 39% in 1926—as compared to 26% for the U. S. Canada's population is only 4 to the sq. mi., and Australia's only 2. Thus England and Wales are 17 times as densely populated as the United States, and 167 times as densely populated as Canada.

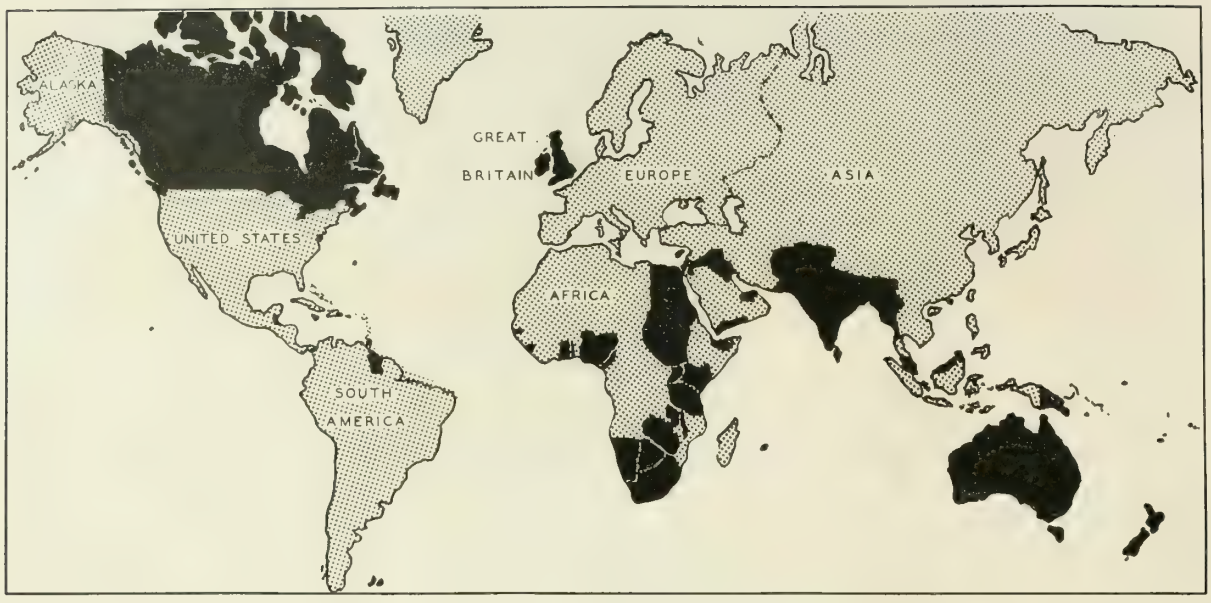



*Airline distances between London and various other European cities*

England, with its people herded together 668 to the sq. mi., with 39% of them living and working in large, closely-packed communities, naturally cannot raise sufficient food to support its population. Approximately 80% of its necessary foodstuffs must be imported. England has coal, iron, tin, but little wood and no oil—and without oil modern mechanized warfare must cease on the ground, in the air, and even to a considerable extent at sea, for many warships are oil-burners.

Everything that England needs and does not produce herself must be imported; and as the country is an island practically everything must be brought there in boats. In exchange for these materials she must export coal, iron, tin and manufactured goods and processed foodstuffs—also in boats. Without the ever-continuing flow of materials, of goods, into and out of England, the economic life of the nation must be interrupted. Stop completely that flow of goods, and you stop the nation's life. Stop only enough of it to disrupt seriously the normal working life of the people, and you paralyze to that extent the fighting power of the nation. To cite only one example among many, if the further importation of oil was halted, it would be only a matter of a comparatively short time before present stocks in storage would be nearing exhaustion, and England would find herself first without motive power for road transport, and at last, without fuel even for her air fleet. She would then be helpless against an enemy air power.

While it is true that no nation is economically self-sufficing—even as large a country as the United States is dependent upon far-off tropical countries for necessities required in domestic manufacture—England is one of the world's most obvious examples of a country that cannot live even on the most reduced scale unless it insures itself of a continuing supply of raw materials and *also* of marketing its manufactured products. For a large percentage of the working population of England depends for employment upon the ability of manufacturers to dispose of their goods in world markets. World trade is her very




*Black areas on the map show the extent of the British Empire, her Dominions, Colonies, Mandates, spheres of British influence, etc.*

life. The people of England merely *stand* on the soil of England; they *live* by means of their ships. And ships are easy prey during a war.

During the German submarine campaign, British, Allied, and neutral vessels sunk by submarines came to the staggering total of 5408, of 11,189,000 gross tons. That was almost a quarter of the entire world's shipping of 1914. In April, 1917, the worst month of the campaign, 430 ships of 852,000 gross tons were destroyed. "One out of every four vessels that left the British Isles in that month never returned," declares the *Encyclopaedia*—an English publication. With the introduction of the convoy system, sinkings decreased, but even so 1103 ships were sunk in the ten war-months of 1918.

#### Destruction by Submarines

This stupendous destruction was accomplished by a half-blind, mole-like subsurface vessel then capable of a speed of only 9 or 10 knots an hour under water. At no time during the war did the Germans have in commission more than 140 U-boats; and for most of the time there were less than a hundred of these commerce destroyers cruising in the war zone. Yet they sent to the bottom 5408 ships, put the English population on short rations, and brought England within sight of starvation and defeat. What will be the effect upon England's sea commerce when a continental power despatches daily from shore bases not one hundred, but hundreds perhaps thousands of airplanes to prey upon the shipping that must come to and depart from England with those life-sustaining cargoes.

The English Channel is only 100 miles wide from Ushant to the Scilly Isles, and only 20 at the Straits of Dover. Its length is 350 miles, and for all of that length it borders the continent. Sinking a ship in that stretch of water would be as easy as spearing fish in a tub. Hence all the Channel ports and the Port of London would have to be abandoned—a ship could not survive to reach or leave there. The great west coast ports of Liverpool and Bristol are not in much happier plight. Liverpool is only about 300 miles from the coast of France, 400 miles from Germany. Modern bombers, capable of speeds of 200 miles an hour, could carry a ton of bombs from France or Germany, drop them on Liverpool, and make the round trip flight in 3 or 4 hours.

The submarine had to hunt for ships or lie in wait for them in the wide reaches of the sea; the airplane will find its prey tied to a dock, a bound and helpless victim. The air force commander who would send his airplanes to cruise over the waters surrounding England would be a subject for laughter by any air strategist. Of course vessels encountered nearing the coasts would be sunk, but that would be merely incidental to the main action of the attacking air force. Vessels must spend much time in port, loading and unloading cargo. In port they are stationary targets, surrounded by other legitimate objectives for air bombardment, such as docks and warehouses, factories, shops or houses. Few bombs will be wasted. It is not unreasonable to suppose that within a week of the outbreak of hostilities the greater part of the shipping in England's ports will be destroyed or sunk at the docks or in the harbors—together with a large percentage of the ships in passage within a hundred miles of the coast.

The question of defense naturally presents itself here. The answer is that no defense against air bombardment yet exists. All that is possible today is interference with it. As to how effective that interference will be must depend upon the amount and the quality of the defense elements. And unfortunately for the cause of defense against air bombardment, what passes for thinking power in the minds of air force commanders the world over has been dominated largely by the superior intellect of a brilliant Italian named General Douhet, now dead. Douhet, a neurotic with a brain keen enough to cut diamonds, worked himself and the world's air force commanders along with him into a state of practically suspended animation, a Nirvana of all-conquering air bombardment power—all floating in thin air, as pointed out in an article in the March, 1936 issue of AERO DIGEST. All that the Douhet Doctrine states is that there is only air bombardment—and no adequate defense against it. The commanders of air forces have given up all but a mere pretense, for public consumption only, that even efficient interference with air bombardment is possible.

#### Counter-bombardment Defense

England's only real defense against air bombardment is counter-bombardment against a continental enemy more self-sufficing, less dependent upon sea-borne commerce. But counter-bombardment cannot inflict upon a continental enemy as vital damage as continental bombardment must inflict upon England with her helpless shipping. Therefore, in a war of bombardment with air forces of equal hitting power, England must lose the decision. The cities of France or Germany or Italy could be destroyed. But the people

(*Continued on page* 58)




# Machinery and Methods in Engine Production

● In the construction of the Ranger Engineering Co. factory at Farmingdale, Long Island, N. Y., there is evident a recognition of the fact that cost and speed of production, as well as quality of the product, are affected by the general design of the plant. Situated on a plot occupying 4 acres of ground, the factory can easily be expanded when either the present methods of manufacture are changed or as business increases.

Built in 1928, the plant consists of a main building and two smaller structures—not as extensive a layout as some of those of the large aircraft engine manufacturers, but highly efficient, modern and especially equipped for turning out in-line aircraft engines.

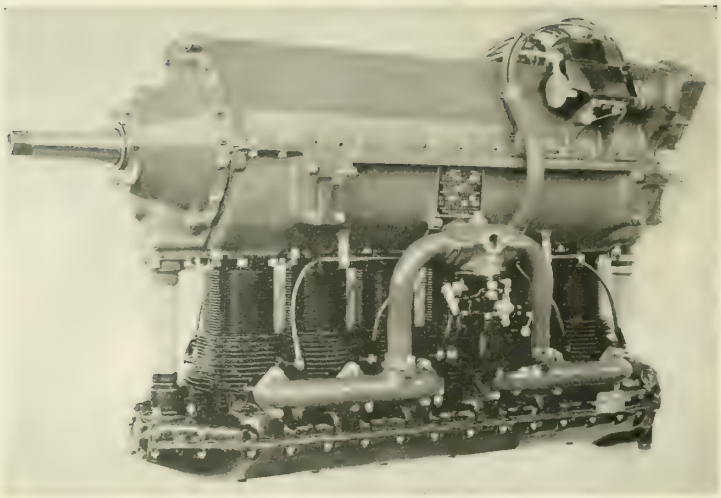
Adjoining an extensive flying field and provided with railroad siding facilities on the north, a main highway on the south and a side road on the west, the Ranger factory is in an ideal location, especially regarding accessibility.

Except for foundry and forge shops, the 40,000 square feet of factory space permit all production requirements for aircraft engine output, and at present capacity can be stepped up to meet a 20-engine-a-month schedule.

The main building is one story high and its saw-tooth type skylight roof provides ample natural lighting facilities and ventilation. Further aids to ideal working conditions are found in the use of suction blowers in the cleaning, bur-



*The 300 hp 12-cylinder direct-drive Ranger engine and some of the departments connected with its production*



*One of the finished products, the 6-cylinder Ranger 6-390*

ring, polishing, heat-treatment, sand blast, plating and painting departments. There is a sufficiency of clear space inside, unobstructed height being 16 ft. and space between columns measuring 22 ft. by 40 ft.

As indicated in the accompanying diagrams, the front portion of the main building has been utilized for the location of executive offices (A); reception room (B); purchasing department (C); experimental and test engineering offices (D); and the planning and scheduling departments (E). Immediately adjacent is the engineering department (F).

The plant manager is located in the planning and scheduling department office and all such work, as well as manufacturing, is under his direction. The experimental and test engineering department controls design, manufacture of parts assembly and tests, and at the present time is devoting the major portion of its efforts to U. S. Navy work.

All material comes through the receiving department (G) after which such special parts as castings, forgings, bar stock, etc., are inspected at the rough store department (H) and then, if accepted, are released for machining. Ninety percent of aluminum castings are purchased from Bohn Aluminum & Brass Corp.; gears from Indiana Gear Works; and various forgings from Canton Drop Forging & Mfg. Co. Inspection is in charge of the chief inspector who supervises all work assigned to this department (J) which is subdivided into floor inspection, finished parts inspection, and purchased parts inspection. Floor inspection is maintained during set-up and while work is progressing through the shop; all purchased machine parts must pass through final inspection before being delivered to the paint shop (T), and plating room (R) and the finished stores room (P).

Ranger Engineering employs a definite material control which requires a specification for all material and parts obtained from outside sources. Every casting, forging, or piece of raw stock is marked for permanent material identification and each has an individual record of chemical analysis, physical test, heat-treatment and other necessary data. In the case of finished parts or material purchased, a certificate stating chemical and physical properties of the part or material must accompany it.

Parts such as crankcases, pistons, connecting rods, cylinder heads, etc., are received from outside sources at the receiving department, and after they are inspected and approved, are routed to (AA) in the main building. Here machines 1 and 2 perform the first milling operation. Then machines 3, 4 and 5 perform the drilling and tapping operation, after which additional milling is accomplished by machine 6. Machine 7 is used to bore the accessory drive in the crankcase while machine 8 does crankcase main bearing boring, facing, etc. Cylinder grooving of the crankcase is done by machines 9 and 10.

Section (BB) is devoted primarily to pistons and cylinders. Here machines 11 and 12 are utilized for piston turning, grooving and boring, while piston milling is accomplished by machine 13. Machines 14 to 17 are used in working shafts, cylinder barrels and other general screw machining work.

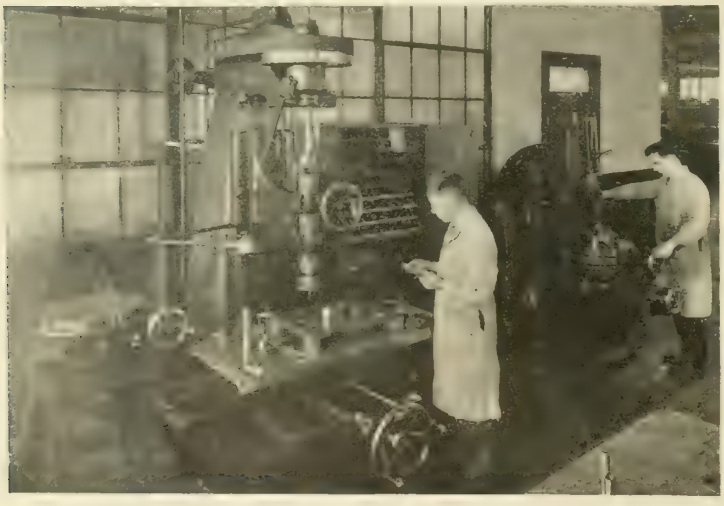
Machines are grouped according to function, the screw and automatics (CC); cylinder barrel and head finning, threading and general production lathes (DD); milling and broaching machines for screws, pins, bushings, studs, etc., (EE); for connecting rods (FF); and grinding machines (GG). The tool shop and experimental department is at (HH) while the tool, jigs and master cribs are at (W) and the master crib at (X).

After completion of machining, finishing operations and inspection, parts are routed to finished stores, from where they are drawn when needed, and routed to the two sections of the assembly department. Those parts forming subassemblies are fed to the assembly benches (O′) adjoining the final assembly line. Sub-assemblies consist of crankshafts and connecting rod assembly; cylinder assembly-valves, valve springs, etc., pumps, etc. The second group of finished parts, (those which are complete and ready for assembly) are fed to a line of benches along the assembly line.

Final assembly of the production engine starts at (O) where the lower half of the crankcase is bolted down to a moveable assembly stand. Procedure is progressive and the engine moves along the line until it reaches completion.

It is then delivered to the test house building, a steel and brick structure located about 350 feet east of the main building. This unit is divided into pro-

*A corner in the tool shop and experimental department*



duction engine test and run-in work (M) and into experimental engine work (N). After engines have been given their required run-in and following completion of necessary tests, they are again returned to assembly, torn down, inspected and given a final test. They are then ready for shipment.

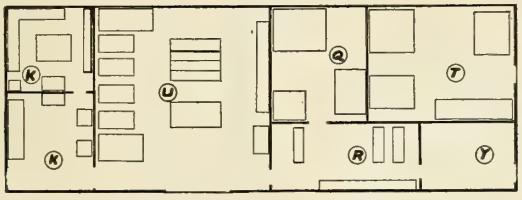
Equipment in the test house consists of a General Electric dynamometer and an air blower system for engine cooling. In addition, there is one fixed and two torque stands, each provided with the necessary instruments for production and test run-in. Engine test procedure and run-in is controlled by the experimental and engineering test department and is based on customer specification requirements, in addition to those required by the Bureau of Air Commerce or the military services where engines are intended for the Army or Navy.

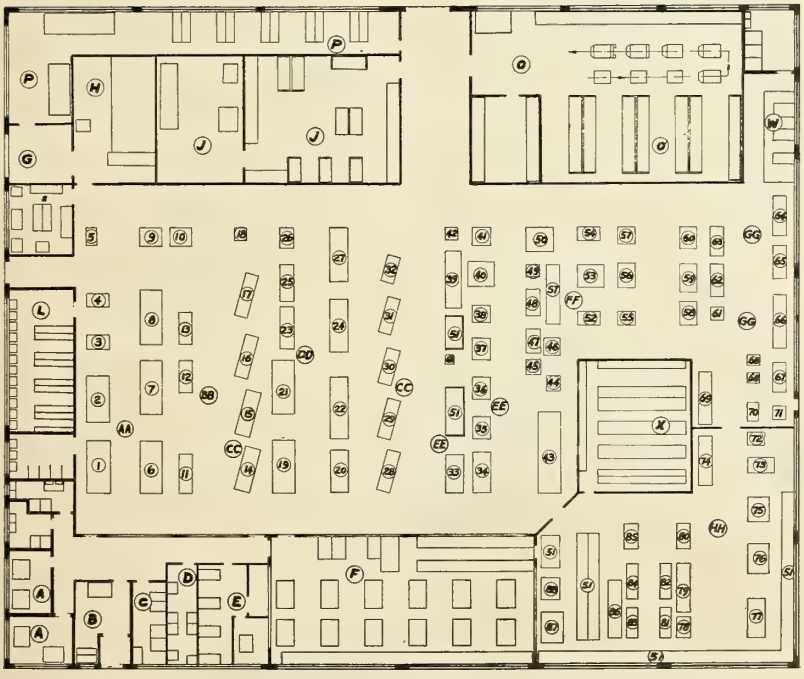
The third unit of the Ranger factory is also a steel and brick structure located immediately behind the main building. In it are maintained facilities for chemical and physical laboratory testing (K) of material either machined or heat-treated in the plant. Equipment includes Olsen & Amsler tensile testing apparatus, a Moore fatigue machine, Brinnell testing equipment, a complete chemical laboratory for material research, as well as a Lietz camera and equipment for microphotography. Also housed in this building are the sandblasting (Q), plating (R), paint (T), heat treating (U) and factory maintenance departments.

The heat treating department is equipped with Surface Combustion furnaces and Homo furnaces provided with Leeds & Northrop recording potentiometer for temperature control. Specifications for heat treatment are controlled by a metallurgist working in conjunction with the experimental and test engineering department.

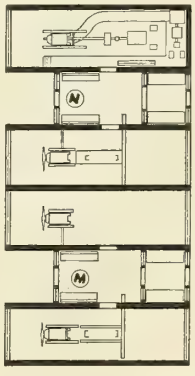
The paint shop has a spray booth and baking oven equipment provided with suction blower ventilation. The plating department has facilities for chrome, cadmium and nickel plating as well as chrome pickling of magnesium alloys, in addition to tumbling barrels.

Ranger is now in production on a series of in-line and Vee-type air-cooled inverted aircraft engines including the model 6-390, a 6-cylinder in-line type developing 150 hp at 2350 rpm; and the 12-cylinder Vee types V-770, developing 300 hp at 2300 rpm, GV-770 (geared) developing 340 hp at 2800 rpm, and the SGV-770 (geared and supercharged) developing 420 hp at 2800 rpm.





LAYOUT OF RANGER ENGINEERING CORP. FACTORY, SHOWING THE ARRANGEMENT OF MACHINERY USED IN PRODUCING IN-LINE ENGINES



**Location of Offices, Departments, etc.**

*A—Administration and executive offices. B—Reception room. C—Purchasing. D—Experimental and testing engineering office. E—Plant manager—Planning & scheduling. F—Engineering. G—Receiving. H—Rough stores (castings, forgings, bar stock, etc.) J—Inspection—chief inspector, floor inspection, finished and purchased parts inspection. K—Chemical and Physical Test Laboratory (material control tests.) M—Production test section. N—Experimental test houses. O—Final assembly, O'-Sub assemblies. P—Finished stores. Q—Sandblasting. R—Plating. S—Burring, cleaning and polishing. T—Painting. U—Heat treating. W—Tool, jigs and fixture crib. X—Master crib. Y—Factory maintenance. AA—Crankcase machinery. BB—Pistons. CC—Screw machines and automatics. DD—Cylinders (barrel and head). EE—Milling and broaching; connecting rods. FF—Drill press dept. GG—Grinding. HH—Tool shop and experimental.*


Milwaukee vertical mill.....1, 2
American radial drill.....3, 4
4-Spindle drill press..... 5
Milwaukee vertical miller..... 6
Brown & Sharp boring mill..... 7
Milwaukee boring mill..... 8
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# GERMAN MILITARY AIRCRAFT (Part 2)

● Germany's new air force program is planned, directed, and coordinated from three main centralized establishments: the seven-story, 2000-room Air Ministry building in Berlin; the air city of Kladow embodying the War Academy, Technical School, and military aviation research and tactical development centers; and the DVL, central research and experimental organization at Adlershof corresponding closely to the NACA laboratories at Langley Field.

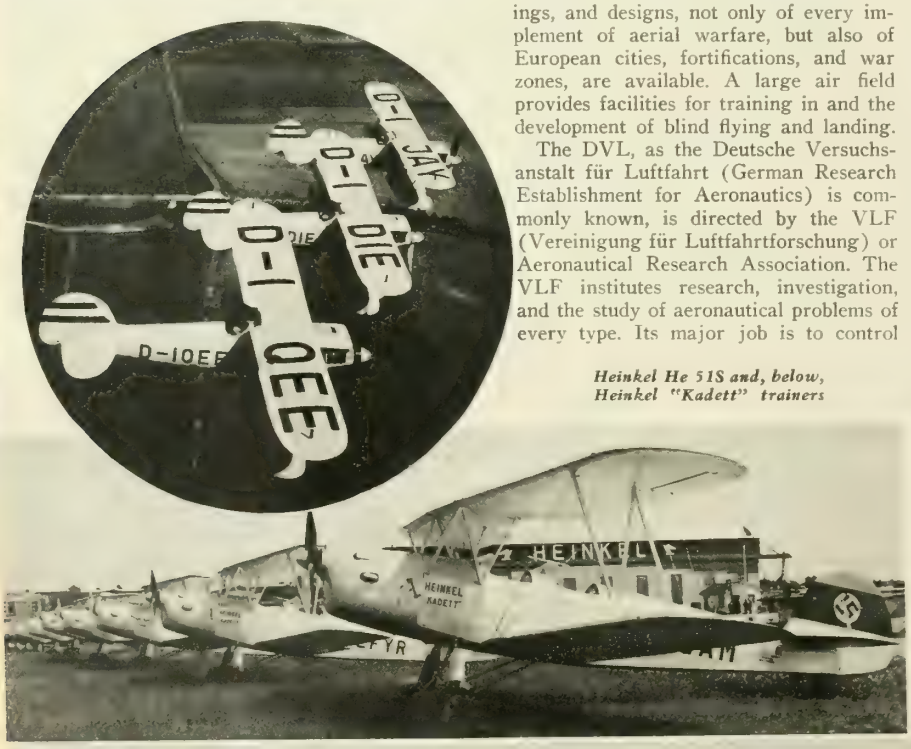
The Air Ministry building occupies a square block and houses a complex administration designed by General Goering to coordinate the newly-created scientific schools, research and training centers, and the command and staff organizations of the German air force. Here radio contact is maintained with frontier outposts, air bases, and other branches of the German army. Little lost motion or time would be involved in conducting a campaign from this efficient and centralized headquarters.

Gatow-Kladow, located near Berlin, is the major activity of the three central branches. Here, all research and tactical information is thoroughly studied, digested, and disseminated through lecture rooms, motion picture theatres, laboratories, and over the radio. Models, drawings, and designs, not only of every implement of aerial warfare, but also of European cities, fortifications, and war zones, are available. A large air field provides facilities for training in and the development of blind flying and landing.

The DVL, as the Deutsche Versuchsanstalt für Luftfahrt (German Research Establishment for Aeronautics) is commonly known, is directed by the VLF (Vereinigung für Luftfahrtforschung) or Aeronautical Research Association. The VLF institutes research, investigation, and the study of aeronautical problems of every type. Its major job is to control and improve the exchange of information and data between the research establishments and the scientists and engineers, and to coordinate their results with the technical staffs of the manufacturers, air transport lines, and the German air force. Divided into eight branches, the VLF conducts research in aerodynamics and hydrodynamics, construction and manufacturing processes, power plant and fuel development, raw material sources and their development and supply, practical flying and training, soaring or gliding, aerial photography and mapping, and medical problems connected with aviation.

There is still another alphabetic agency and Goering brainchild—the ZWB, the Office of Aeronautical Intelligence operating under the DVL. Its primary function is to collect, classify, and duplicate scientific and technical reports both domestic and foreign (especially the latter). It issues its own confidential and restricted notes for the technical departments of the Luftwaffe and publishes two periodicals—*Luftwissen* and *Luftfohrtforschung*, both of which serve the aviation industry in general.

This system, organized to develop the technical side of German aviation, coupled with the natural engineering ability of the Germans, bids fair to place Germany in the forefront of world aviation unless other countries take similar steps to develop and coordinate their aeronautical progress. Expansion of the Luftwaffe and the hurried development of new planes and engines has already given proof of the thoroughness with which Goering and his aides have planned and organized.




*Heinkel He 51S and, below, Heinkel "Kadett" trainers*



*The Focke-Wulf FW 56A high-wing single seater*

PEYTON M. MAGRUDER and LUCIEN ZACHAROFF

**Part I of this series covered the development, disposition, and strength of the new German Air Force. Part II describes the various training planes, fighters, fighter-bombers, naval and seaplane types now in active use in a digest of types, constructional features, and performances.**

The German air force, as explained in Part I of this series (December, 1936, AERO DIGEST), is composed principally of bombers. It must be realized that a majority of the types now in active service were designed ostensibly as civil or commercial planes, but were in reality disguised bombers, attack-bombers, and fighters. The rapid development of the air force necessitated the construction of a number of training planes to provide a sufficiency of pilots prior to the building of the new military types. This had been done over a period of years and, as a result, there is at present a wide variety of trainer types which will be briefly described to properly present a complete picture of German military aviation as it is today.

### Training Planes

Six major companies are producing approximately twelve different models of primary and advanced training planes. These ships have power plants ranging from 80 hp to 240 hp and maximum speeds from 112 mph to 177 mph. Empty weights vary from 770 lbs. to a maximum of 1870 lbs. and stalling speeds, from 33 mph to 62 mph.

The Arado 66c is a two-place biplane with marked stagger and sweep-back. The wings, constructed of pine spars, limewood ribs, and fabric covering, have Frise type balanced ailerons, and are rigidly braced by N-shaped interplane and cabane struts. The steel tube fabric-covered fuselage is of oval cross section. Tail unit, of monoplane type, is strut braced with the horizontal tail plane being carried on top of a short fin. Cockpits are equipped with complete radio and photographic apparatus and have quick-opening side doors to provide easy exit. One 240 hp Argus As 10 8-cylinder inverted Vee air-cooled engine gives a maximum speed of 131 mph, cruising speed of 109 mph, landing speed of 45 mph, and a service ceiling of 14,760 ft. Range is 440 miles and weight empty, 1870 lbs. This trainer may be easily converted into a single float seaplane for naval training.

The Arado Ar 69a and 69b types are somewhat similar, the 69b being a modification of the earlier Ar 69a. A two-seat light training plane, the Ar 69b, has a 150 hp Siemens Sh 14a radial air-cooled engine which gives a maximum speed of 114 mph and a landing speed of 43.4 mph. Wing structure is similar to that of the Ar 66. Fuselage is of rectangular section built up of steel tube longerons and covered with metal panels forward and fabric aft. Fully loaded the Ar 69b weighs 1419 lbs. and empty, 1111 lbs. Climb to 3300 ft. requires 3.3 minutes.

One of the principal advanced training planes is the single-seat high wing Arado Ar 76 which was fully described in the May, 1935 issue of AERO DIGEST. The well-braced parasol wing is of typical Arado structure having two box spars of spruce, with limewood ribs, the whole fabric-covered. The rectangular shaped fuselage is of welded steel tube covered forward with magnesium panels and aft with fabric over a light wood framework. A 200-240 hp Argus As 10c 8-cylinder inverted 90° Vee air-cooled engine (on quickly detachable mountings) gives a maximum speed of 169 mph, landing speed of 62 mph, and a ceiling of 20,990 ft. Empty weight is 1551 lbs. and weight fully loaded 2178 lbs.

Two popular training planes are the Bücker Bu 131 *Jungmann*, a primary two-



*Focke-Wulf FW-44 "Stieglitz" with two types of engines*





*The Heinkel He 64C training monoplane*

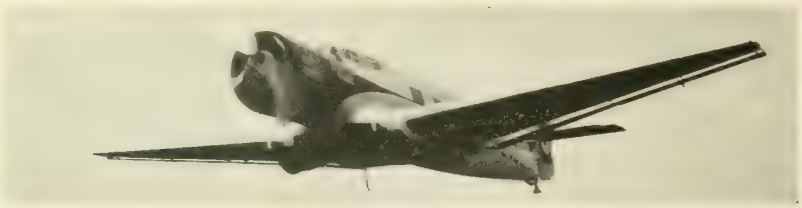
place biplane trainer, and the Bu 133 *Jungmeister,* a single place advanced training biplane. Both have identical wing cellule arrangements and welded metal- and fabric-covered chrome-moly fuselages. Upper and lower wings are interchangeable and are fabricated of I section wood spars, wood ribs, and conventional drag bracing, the whole being fabric covered. Landing gear in both cases consists of two streamline side struts incorporating steel spring oil-damped shock-absorbers. A 140 hp Hirth HM 6-cylinder in-line inverted air-cooled engine provides a maximum speed of 143 mph, a landing speed of 50 mph, and a cruising range of 310 miles for the *Jungmeister* which weighs 902 lbs. empty and 1287 lbs. fully loaded. The *Jungmann* is equipped with an 80 hp Hirth HM 60R air-cooled 4-cylinder in-line engine which gives a maximum speed of 105 mph, landing speed of 44 mph, ceiling of 13,120 ft., and a range of 400 miles. Empty the Bu 131 has a weight of 738 lbs. and fully loaded, 1320 pounds.

The Fieseler F5 two-place low-wing cantilever monoplane is equipped with the 80 hp Hirth 4-cylinder engine. Wings are quickly detached and fold back against the fuselage. They are fastened to the built-in center section stubs by conical bolts and quick-release joints. Slotted flaps extend along the full trailing edge with outer portions acting as differentially controlled ailerons. The landing gear, of vertical cantilever type, is well streamlined and placed far forward to prevent nosing over in soft ground. Maximum speed is 118 mph, landing speed 40 mph, ceiling 13,120 ft., and range 370 miles. Weight empty is 771 lbs. and fully loaded 1344 lbs.

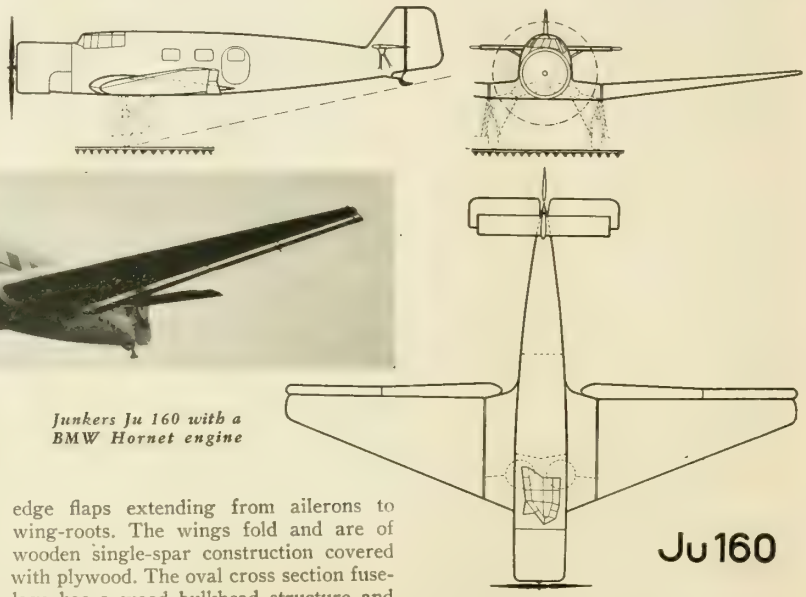
Focke-Wulf produces two outstanding training types which are in general use throughout Germany. The FW-44F *Stieglitz* is a two-place single bay braced biplane with equal span, well staggered, slightly swept-back wings, built up of box type compression ribs and pine wood spars. Fuselage is of welded steel tube rigidly braced and is metal- and fabric-covered. Performance with a 150 hp Siemens Sh 14a engine is as follows: maximum speed, 117 mph; landing speed, 46 mph; ceiling, 14,432 ft; and range, 357 miles. Weight empty is 1166 lbs. and fully loaded, 1760 lbs.

The Focke-Wulf FW-56A, a single-place high wing monoplane, is powered by a 240 hp Argus As 10 engine which gives a top speed of 177 mph, landing speed of 56 mph, and ceiling of 19,840 ft. Wing structure consists of a steel tube anchored to both upper and lower fuselage longerons. Short backwardly-hinged radius-rods carry the wheel-axles and are sprung by oleo-spring units.

Heinkel produces two successful training types—the He 64c, a low wing cantilever monoplane; and the He *72 Kadett,* a two-place open cockpit biplane. The He 64, originally designed as a two-place sport plane, has automatic slots which extend along the leading edge of the wing and operate in conjunction with trailing edge flaps extending from ailerons to wing-roots. The wings fold and are of wooden single-spar construction covered with plywood. The oval cross section fuselage has a wood bulkhead structure and is completely covered with plywood. A 150 hp Argus As 8R inverted air-cooled engine provides a maximum speed of 152 mph, a landing speed of 33 mph, and a range of 940 miles. Fuel consumption at cruising speed is approximately one gallon in 30 miles.



*Junkers Ju 160 with a BMW Hornet engine*




The He *72 Kadett* is strongly staggered with wings of wooden two-spar construction, plywood- and fabric-covered. Fuselage is of welded tube and is metal- and fabric-covered. Landing gear is of the braced, split-axle type with oleo shock absorbers. A 150 hp Siemens Sh 14a engine gives a maximum speed of 112 mph, landing speed of 50 mph, and service ceiling of 11,480 ft. Fully loaded the *Kadett* weighs 1980 lbs. and empty, 1298 lbs.

#### Fighter-Bombers

Fighter-bombers or light attack bombers are at present limited to two types, although several new designs are in the experimental stage. Both of these models were designed as high performance mail or light transport planes but were so constructed as to be easily converted to military use.

A low-wing cantilever monoplane, the Heinkel He 70, is an outstanding example of German design and ingenuity. The wing, tapering in chord and thickness, is cleanly faired to the fuselage by swept up wing roots which have a negative angle of incidence to eliminate the possibility of "tail-buffeting." The one piece wing is built up of spruce and plywood box spars, closely spaced ribs, and plywood covering. Split flaps extend inboard from the narrow-chord ailerons. The fuselage is oval, of dural monocoque, with countersunk rivets used in securing the dural sheet to the hollow frames and longitudinal members. There are no external projections on the fuselage, cantilever tail, or wing. The retractable landing gear consists of two units, each of which comprises a tripod, one leg of which is a long stroke oleo gear. This leg and the top of the backwardly and inwardly-inclined leg are hinged to the front and rear spars respectively. The top of the third leg, which, in the open position, slopes backward in line with the oleo-leg, slides on a rail within the wing and by sliding this leg inwardly the wheel is drawn up within the wing by a cable, the retracting mechanism being worked hydraulically with oil. Fairing plates cover completely the recesses in the wings when the gear is fully retracted. The tail skid, oleo sprung, also retracts automatically with the landing gear. The Ethylene-glycol cooled BMW VI 12-cylinder Vee geared engine develops 630 hp at 1600 rpm and gives a maximum speed of 222 mph, landing speed of 62 mph, service ceiling of 19,680 ft., and maximum range of 870 miles. Other features include an adjustable pilot's seat, complete "blind-flying" equipment, and two-way



Shell Aviation photo

*The 630 hp Heinkel He 70 has a speed of 200 mph*

radio apparatus. Weight empty is 5060 lbs. and fully loaded 7282 lbs., of which approximately 1300 lbs. may be used for light bombs.

The Junkers Ju 160, a development of the Ju 60, the first Junkers to have retractable landing gear, is a six-passenger cabin low wing cantilever monoplane which may easily be converted to a light bomber or attack-bomber type. Of all-metal structure, it is equipped with a 644 hp BMW *Hornet* 9-cylinder air-cooled radial engine driving a three-bladed propeller. Unusual features are: the external airfoil type combination flap-ailerons, countersunk rivet construction, and completely retractable landing gear, each unit of which swings upwards and inwards into the wing roots. With a total useful load of 2530 lbs. the gross weight is 7370 lbs. Maximum speed is 208 mph, landing speed 56 mph, service ceiling 17,056 ft., and range 621 miles at cruising speed of about 196 miles per hour.

#### Fighters

Development of single seat fighters for the German air force has necessarily lagged behind construction of other types which were easier to disguise as commercial planes. As a result, there is only one single seat fighter now in active use in large quantities, the Heinkel He 51, a biplane. Arado, Henschel, Dornier, and Scheller now have under production experimental models of various types, all of which are said to have extremely high performances. The new Arado fighter is claimed to have a top speed in excess of 290 mph, while Henschel and Dornier are producing a low wing cantilever type with a top speed of 310 mph. A number of designs are being prepared so that mass production of fighters can be started on a moment's notice. As pointed out in Part I of this article, approximately 1000 fighters a month can easily be produced by the present Goering system which is designed solely for a tremendous output in a national emergency. The results of this system have already shown that such a planned program is most workable.

The present fighter, the He 51, is of the single-bay type with a wire-braced landing gear and a BMW liquid-cooled engine. Top speed is approximately 217.3 mph and landing speed 63 mph. Armament consists of two fixed machine guns firing forward through the propeller disc. Armament of the latest experimental fighters includes a light canon as well as from two to four machine guns.




*Arado Ar. 66C two-seater*




*Arado Ar. 76 advanced trainer*




*Jungmann "Bucker" Bu. 137*



*Dornier Do-22 observation-scout plane for Naval service*

#### Seaplanes

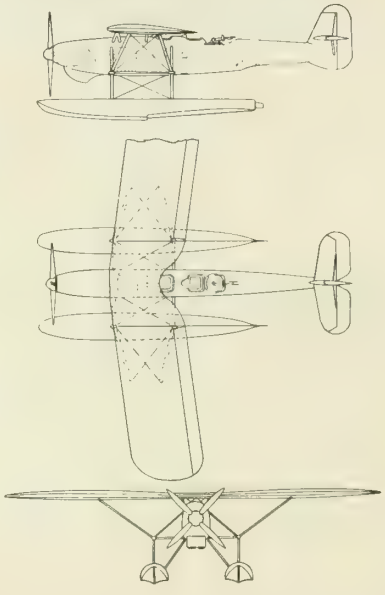
Development and production of seaplanes for the German Navy has been retarded mainly because of the urgent deman for bombers with which to equip the newly-formed Luftwaffe squadrons. A second reason has been the slow growth of the fleet itself. However, with the recent sudden expansion of the German Navy and the laying of the keels of two aircraft carriers a need has arisen for naval types in every category.

The accompanying table lists the characteristics of the predominant types of seaplanes now in use either by the German Air force or by commercial air lines. All, however, have possible military use ranging from the Arado trainer Ar-66 to the Junkers 52, a heavy bomber. The single-float Ar-66 is similar to the landplane trainer of the same make described above and the Dornier *Wal,* the predecessor of the Do-18, is too well known, through its many South Atlantic flights, to more than mention. The October 1936 issue of AERO DIGEST featured a description and complete specifications of the Do-18 flying boat, two of which have proved their worth by making a round-trip Atlantic crossing as a preliminary to proposed Lufthansa North Atlantic mail and passenger service.

The Dornier Do-22 is a twin-float observation scout now being supplied to units of the Germany Navy. Of welded steel tube fuselage, fabric covered, the Do-22, powered with a 12-cylinder 630 hp BMW VI engine has a maximum speed of approximately 196 mph. With a gross weight of 5250 lbs. range is estimated to be 675 miles.

The Dornier Do-12 *Libelle,* a four-place amphibion is equipped with a 240 hp Gnôme-Rhône K-5 radial engine and has a maximum speed of 129 mph, landing speed of 56 mph, ceiling of 14,760 feet, and range of 621 miles with a crew of two. Auxiliary wing floats provide transverse lateral stability while the retractable landing gear withdraws completely into the upper sides of the hull.

The Junkers W-64 is the type in which Hünefeld and Fitzmaurice flew the Atlantic in 1928 and which later was extensively employed for mail service by catapulting from the steamships *Bremen* and *Europa.* Another type of seaplane in constant use for a wide variety of commercial and naval purposes is the twin-float Ju-52 which may either be equipped with 660 hp BMW *Hornets* or 550 hp Junkers *Jumo* Diesels. Of identical structure, excepting the floats, to the landplane type already described, the Ju-52 seaplane has only slightly inferior performance.

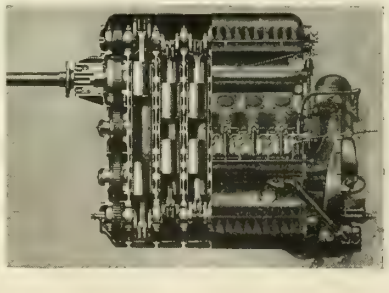


*The Dornier Do-22 seaplane*

#### Glider and Engine Development

One of the most interesting developments in post-war German aviation has been the extensive training of pilots who solo first with gliders and receive more advanced training later with powered aircraft. Soaring, in the United States and other countries, has received a tremendous impetus through the advances made in this field of aeronautics by German pilots and engineers.

*The Junkers Diesel aircraft engine*



Perhaps the best example of the present high technical level of German aviation is the successful development of the compression-ignition or Diesel engine both for lighter and heavier-than-air aircraft as exemplified by the Junkers *Jumo.* Also, the construction and performance of the *Hindenburg* has elicited admiration of engineers in every country and has done more to sell to the American public the cause of lighter-than-air craft than any other factor since the loss of the *Akron* and *Macon* put a temporary stop to the promising development of that field of aviation in the United States.

Among these indices of advanced technical accomplishments must be mentioned the equipping of all two- and three-engined planes with Sperry or Siemens gyropilots, Telefunken and Sperry radio compasses, and complete "blind" and night flying and landing instruments. A majority of the Ju-52s are provided with Lorenz-type blind-landing instruments utilizing ultra-short waves of 7.85 to 9.0 meters. Provisions are being made for the installation of similar equipment in all future planes having more than one engine or weighing more than 5000 lbs.

Present trends are difficult, if not impossible, to analyze until more of the experimental types are released, but the most important factors in Germany's rearmament of her air force have been the systematic development of raw materials, pilots, engineers, and aircraft factories designed solely for mass production on short notice.

### GERMAN MILITARY AIRPLANES

(Continued from the December issue)

| | Total HP | Gross Weight (lbs.) | Maximum Speed (mph) |
|---|---|---|---|
| **TRAINING PLANES** | | | |
| Arado Ar 66c | 240 | 2800 | 131 |
| Arado Ar 69b | 150 | 1419 | 114 |
| Arado Ar 76 | 240 | 2178 | 169 |
| Bücker Bu 131 | 80 | 1320 | 105 |
| Bücker Bu 133 | 140 | 1287 | 143 |
| Fiesler F.5R | 80 | 1344 | 118 |
| Focke-Wulf FW-44F | 150 | 1760 | 117 |
| Focke-Wulf FW-56 | 240 | 2167 | 177 |
| Heinkel He 64c | 150 | 1716 | 152 |
| Heinkel He 72 | 150 | 1980 | 112 |
| **FIGHTERS & FIGHTER-BOMBERS** | | | |
| Heinkel He 51 | 650 | 5050 | 217 |
| Heinkel He 70 | 630 | 7286 | 222 |
| Junkers Ju 160 | 644 | 7370 | 208 |
| **SEAPLANES** | | | |
| Arado Ar-66 | 240 | 3075 | 119 |
| Dornier Wal | 1200 | 22040 | 143 |
| Dornier Do-18 | 1100 | 20240 | 155 |
| Dornier Do-C2 | 650 | 7270 | 149 |
| Dornier Do-22 | 630 | 5250 | 196 |
| Dornier Do-12 | 240 | 3197 | 129 |
| Junkers W-64 | 660 | 7050 | 149 |
| Junkers Ju-52 | 1980 | 20900 | 173 |

# EDITORIALS

★

**"In the light of present world conditions, we cannot afford to neglect measures for our own national safety. A secure defense is our most dependable guarantee against aggression by others. I am glad to report that the appropriations of the past two years have sufficed to permit a notable expansion in the numbers of our aircraft."**
**Harry H. Woodring, Secretary of War**

## Lowered Fares Stimulate Traffic

Decision of some airlines to reduce fares during winter operations created more than a slight raising of eyebrows among companies who take a stand-pat attitude on the fare question.

Air transport operators are offering a premium service for which the modern traveler does not hesitate to pay extra fare, yet it is a fact that the high fares for air travel have kept away many who want to travel by plane. The recent experience on the railroads supports the contention that if fares are low, more people will travel, and in this matter air travel is no different than surface travel. It is sound business to fly full planes at slightly lowered fares than to fly half or three-quarter full planes at higher rates. The difference between the reduced fare and the regular fare does not offset the difference between the net revenue of a plane half full and one full.

Traffic returns of two of the companies who operated at the lower rates during November are significant; one reported an increase of 122 percent in the number of passengers, and the other experienced the most active month in its history, passengers on this line exceeding by 21 percent those carried the previous month. Better weather conditions in November may have had some bearing on these increases, but it is likely that lowered fares contributed more than a small share. More passengers would have flown if equipment to handle the increased demand was available. Business returns focused attention on the fact that the reduced rates are popular.

This year we anticipate that more than 1,250,000 airline passengers will be carried by American operators. We raise the ante of our previous estimates because the new larger and faster transports coming will not only carry more passengers in greater luxury and comfort, but will provide an incentive to the passenger who has never been quite sold on the idea of flying.

Not much has been heard from the Air Transport Operators Association recently, but if it tackles the fare proposition with a more than open mind and outlines a plan which will benefit the entire transport industry, it will have proven the necessity for its existence.

## Work of the Associations

When the National Aeronautic Association went into its coma and the industry was left without an adequate body to represent its interests, many state aviation associations were formed to step into the breach and protect aviation in the states.

Unscrupulous politicians see aviation as a rich plum, which fast ripening, makes a choice morsel for political patronage or even personal gain. Had the NAA functioned as it should, these racketeering antics would never have started. But the NAA has been notoriously impotent, incapable of dealing with problems of the industry.

In New York the state aviation association not only forestalled harmful legislation, but revised and rewrote a bill which will stand open inspection and is worthy of passing both Houses. Virginia also has a quick-thinking association which may have inspired the Virginia State Planning Board to publish one of the finest volumes of aviation in Virginia. The detail and approach plans of airports are excellent—a worthy and necessary contribution to aviation safety.

Michigan and Florida, too, have made noteworthy contributions to aviation progress. These are just a few examples of what the state aviation associations can do. We owe a vote of thanks to all of them. May they prosper and flourish.

## An Opportunity For Congress

One of the first disagreeable jobs the new Congress must tackle is the national budget. Unobtrusively blended into the intricate maze of stupendous figures for national defense will be the modest appropriations proposed for the air services of our Army and Navy.

Custom invariably dictates that it is best to ask for more appropriations than you need, because you won't get them, but there might be enough left after the legislative committees slice off a few million dollars here and another few million there. Last year Congress practically unanimously passed an Army bill which calls for the purchase of 4000 planes in the next five years—at the rate of 800 a year. The joker was that there was no money left in the budget to buy these planes then, but now it is mandatory that these warcraft be purchased and the appropriations committees must earmark the necessary cash to pay for them.

Eight hundred planes a year is not impressive compared to what the foreign powers consider adequate. But it is more than the Army Air Corps got before. Naval officers strongly are in favor of more planes to fill fleet requirements in the light of expected action by other sea powers. To strengthen the Navy's air arm simultaneously with the increase of its sea strength, officials will require $30,000,000 during the next fiscal year for almost 400 new planes. The general naval expansion program is also an accepted fact by Congressional order and calls for a total of 1910 planes by 1942, compared with the publicized present strength of 1311.

## Air Mail Stamps Out of Date

England takes the next step in the logical development of air transportation on April 1 when an improved air service to South Africa goes into effect. Without extra charge, the new service will carry all first-class mail offered along the route by countries participating in the ambitious scheme.

This is the initial stage in a most comprehensive program of ail mail expansion, providing eventually for transport of all first-class mail by air throughout the British Empire, without surcharge. It needs the multiplication of every effort, demanding the use of a greatly augmented fleet of aircraft, improvement of ground organization, and a substantial increase in operating personnel. It calls for intensive flying day and night and for increased cruising speeds. Ultimately, the British plan may extend beyond the limits of the Empire and embrace the globe.

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# *Aviation Products*

# Theoretical Determination of Air Forces and Moments on Wings

WILLIAM H. MILLER and PEYTON M. MAGRUDER

● In the November issue of AERO DIGEST[1] the authors presented a solution of the equations of equilibrium of an airplane for constant angle of glide and velocity, and gave a method of calculating, approximately, the magnitude and distribution of air load on the horizontal tailplane for that condition. As a continuation of that discussion, the problem of distributing the air load over the spans of the individual wings of the cellule is now considered. Initial remarks will, therefore, be directed toward the application of the classical methods of hydrodynamics to the calculation of the flow about a monoplane of finite span.

In the treatment of the airfoil of finite span, in three-dimensional motion, it will be assumed that the chord is small in comparison with the span and that the "aerodynamic centers" of the wing sections lie on a straight line perpendicular to the direction of motion. The latter assumption is seldom true for actual wings which, in general, have sweepback and dihedral. However, for purposes of determining the spanwise loading, the effects of small degrees of sweepback and dihedral may be neglected.

If the lift varies across the span of a wing, the upper and lower surface pressure differences will decrease towards the tips, causing the streamlines over the upper surface to flow slightly inwards (towards the center) and those passing beneath to flow outwards (towards the tips). As these streamlines leave the trailing edge of the wing they form, as a result of the "cross-flow," a surface of discontinuity composed of the trailing vortices in the wake. The flow about any airfoil section of the wing, therefore, differs from the flow which would occur around the same section in a wing of infinite span. This alteration of the flow is due principally to the influence of the trailing vortex system which induces a normal component of velocity, and changes the angle of attack, at each point along the span. That is why we are interested in the so-called "vertical flow" past a straight line in a perfect fluid. For, a line of finite length which, though straight, is in the instantaneous process of distorting itself as it moves downward in an infinite mass of fluid (otherwise at rest) presents an analogy to the monoplane with variable induced velocity along its span.

Referring to figure 1, let the origin of coordinates be taken at the center of the wing span, with the $x$-axis horizontal and the $y$-axis vertical. The wing is assumed to be replaced by a "lifting line" of equal span.

(1) Miller, Wm. H., and Magruder, P.M., *Tail Loads in a Steady Dive*. AERO DIGEST, Nov. 1936

Points along the span $b$ are therefore given by

$$x = -\frac{b}{2}\cos\theta \quad \ldots\ldots(1)$$

which relation may be considered as a defining equation for $\theta$.

The two right-angle components of the resultant velocity in the $x$-$y$ plane will be taken as $u$ along the $x$-axis and $v$ along the $y$-axis. That is: $u = dx/dt$ and $v = dy/dt$ where $dx$ and $dy$ are the displacements of the particle in the time $dt$. The pressure at any point $(x,y)$ will be denoted by $p$. We may then write in general:

$$\frac{d(\ )}{dt} = \frac{\partial(\ )}{\partial t} + \frac{\partial(\ )}{\partial x}\frac{dx}{dt} + \frac{\partial(\ )}{\partial y}\frac{dy}{dt} \quad \ldots\ldots(2)$$

where any one of the dependent variable $u$, $v$, or $p$ may be placed in the parentheses.

Now at any given point $(x,y)$, the mass flow (of unit depth normal to the $x$-$y$ plane) may either increase or decrease, inside of an imaginary curve, fixed in space and surrounding the given point. This change in volume must equal the flow out across the curve. Expressed mathematically[2]

$$\frac{\partial}{\partial t}\int\int \rho\, dx\, dy = -\int (\rho u)dx + (\rho v)dy$$

$$= -\int\int \left\{\frac{\partial(\rho u)}{\partial x} + \frac{\partial(\rho v)}{\partial y}\right\} dx\, dy$$

Hence

$$\frac{\partial \rho}{\partial t} + \frac{\partial(\rho u)}{\partial x} + \frac{\partial(\rho v)}{\partial y} = 0 \quad \ldots\ldots(3)$$

Relation (3) is commonly referred to as the "equation of continuity" for planar flow[3]. Assuming constant density, we have

$$\partial u/\partial x + \partial v/\partial y = 0 \quad \ldots\ldots(4)$$

or $\partial u/\partial x = -\partial v/\partial y$. Now equation (4) is the condition for the existence of an exact differential of the form

$$u\, dy - v\, dx = d\psi = 0$$

(2) Wilson, E. B., *Advanced Calculus*.
(3) Lamb, H., *Hydrodynamics*.

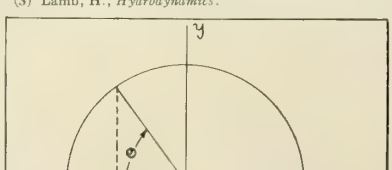


FIG 1

Then $\partial\psi/\partial y = u$ and $-\partial\psi/\partial x = v$ (5)

and $dy/dx = v/u$. Which means that the streamlines are given by $\psi$ = Constant.

Let us write, also, by definition

$$d\phi = u\, dx + v\, dy$$
$$= (\partial\phi/\partial x)\, dx + (\partial\phi/\partial y)\, dy$$

Then $u = \partial\phi/\partial x$ and $v = \partial\phi/\partial y$. The functions $\psi$ and $\phi$ are respectively termed the "stream function" and "velocity potential."[3] The equation of continuity becomes

$$\partial^2\phi/\partial x^2 + \partial^2\phi/\partial y^2 = 0 \quad \ldots\ldots(6)$$

Also, since $\phi$ is assumed to be an exact differential

$$\partial^2\phi/\partial x\partial y = \partial^2\phi/\partial y\partial x$$

Therefore

$$\partial^2\phi/\partial x\partial y = \partial^2\psi/\partial y^2$$

and

$$\partial^2\phi/\partial y\partial x = \partial^2\psi/\partial x^2$$

We note that if a "velocity potential," $\phi$ exists

$$(\partial^2\psi/\partial x^2) + (\partial^2\psi/\partial y^2) = 0 \quad \ldots\ldots(7)$$

Textbooks[4] on the theory of functions show that equations (6) and (7) are the conditions for the existence of an analytic function $F(z)$ of the complex variable $z = x + iy$, which may be written

$$F(z) = \phi(x,y) + i\psi(x,y)$$

We then have

$$dF/dz = \partial F/\partial x = (\partial\phi/\partial x) + i(\partial\psi/\partial x)$$
$$= \partial\phi/\partial x - i(\partial\phi/\partial y) = u - iv \quad \ldots\ldots(8)$$

Consider now the "vertical flow" about a straight line, which is moving with a velocity $-v_o$ at right angles to itself, in an infinite mass of fluid. We can easily verify that this type of motion is represented by the function[3]

$$F = i(b/2)v_o \left\{(2z/b) - i\sqrt{1-(2z/b)^2}\right\} \quad \ldots\ldots(9)$$

For the velocity function is

$$\frac{dF}{dz} = iv_o + \frac{2z/b}{\sqrt{1-(2z/b)^2}} = u - iv \quad (10)$$

and for points along the line ($y = o$) it is clear that $v = -v_o$, the constant downward velocity of the line itself.

Consideration of the straight line flow analogy led Munk[5] to write down a more gen-

(4) Townsend, E. J., *Functions of a Complex Variable*.
(5) Munk, Max, *Fluid Dynamics for Aircraft Designers*.

# Attention "FROST BITE" FLIERS!



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AVIATION PRODUCTS




● Examination of Alcoa Aluminum Aviation castings by X-Ray photography is a part of our regular quality control procedure. This painstaking study has led to casting innovations which provide the industry with sounder, safer, and more reliable castings. From such studies come the thin, deep, integral fins on this cylinder head. They help raise the limits of engine performance. (Photo taken in X-Ray Division of Aluminum Research Laboratories).

ALCOA ALUMINUM

eralized type of function leading to a variable velocity $(-v)$ at points along the span of a monoplane without dihedral; viz.:

$$F = i(b/2)V\sum_{n=1}^{n=\infty} A_n\left( [2z/b] \pm i\sqrt{1-(2z/b)^2}\right)^n \quad \ldots\ldots(11)$$

Let $z = x + iy = -b/2 \cos(\theta + i\eta) = -(b/2)\cos\zeta$ where $x = (b/2)\cos\theta\cosh\eta$ and $y = (b/2)\sin\theta\sinh\eta$.
Then

$$F = i(b/2)V\sum A_n (\pm i\sin n\zeta - \cos n\zeta) \quad \ldots\ldots(11a)$$
$$= \phi + i\psi$$

The velocity potential is

$$\phi = \pm (b/2)V\sum A_n \sin n\zeta \quad \ldots\ldots(12)$$

and the stream function

$$\psi = -(b/2)V\sum A_n \cos n\zeta \quad \ldots\ldots(13)$$

Then

$$\frac{dF}{dz} = \frac{\partial F}{\partial x} = \frac{\partial\phi}{\partial x} + i\frac{\partial\psi}{\partial x} = u - iv$$

The induced velocity at any point $x = -(b/2)\cos\theta$ along the lifting line is

$$v = \partial\psi/\partial x = -V\sum_{n=1}^{n=\infty} nA_n \frac{\sin n\theta}{\sin\theta} \quad \ldots\ldots(14)$$

It appears, therefore, from the analogy of the "lifting line" that the normal velocity, $v$, induced at any point along the span of a monoplane by its own system of trailing vortices, may be expressed in terms of (14).

Consider next the flow about a given airfoil section of the wing. The circulation flow combined with the general stream flow with velocity, $V$, creates a lift force the magnitude of which is given by the Kutta-Joukowsky formula[6]

$$dL = (\rho V\Gamma)dx \quad \ldots\ldots(15)$$

where $\rho$ = mass density of air
$V$ = velocity of forward motion
$\Gamma$ = circulation of velocity around wing section.

By the same theorem the transverse flow combined with the circulation flow causes an "induced drag" of magnitude

$$dD_i = (-\rho v\Gamma)dx \quad \ldots\ldots(16)$$

This, however, is only part of the drag; for, without induction from the system of trailing vortices there still remains for the wing without "end losses" the so-called "profile" or "section" drag consisting of the

(6) Joukowsky, N., *Aerodynamique.*

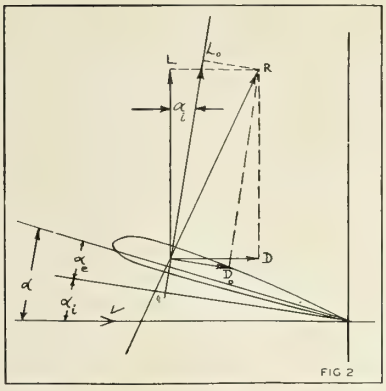


FIG 2

friction on the airfoil surface and the form drag associated with the turbulence in the wake. Denoting this latter drag by $D_o$ it appears from (15) and (16) that the total drag per unit of span of the finite wing is

$$D = D_o + D_i = D_o + (-v/V)L$$
$$= D_o + L\left|\frac{v}{V}\right| \quad \ldots\ldots(17)$$

The geometrical interpretation of equations (15) and (16) leads to a fundamental relation between the angle of attack of an element of an infinite wing and that of a finite wing when the resultant force $R$ per unit of span is the same in each case.[7] Referring to figure 2, note that $R$ may be resolved first along the lift ($L_o$) and drag ($D_o$) axes for the infinite wing and, also, corresponding $L$ and $D$ axes for the finite wing. The angles of attack are say, $\alpha_e$ for the infinite wing and $\alpha$ for the finite wing. When

$$L_o = L\cos(\alpha - \alpha_e) + D\sin(\alpha - \alpha_e)$$
$$D_o = D\cos(\alpha - \alpha_e) - L\sin(\alpha - \alpha_e)$$

Or, since $(\alpha - \alpha_e)$ is a small angle

$$L = L_o \text{ (Approx.)}$$
$$D = D_o + L(\alpha - \alpha_e) \quad \ldots\ldots(18)$$

Comparing (17) and (18) we note that for the wing element, we have, approximately,

$$\alpha - \alpha_e = -v/V \quad \ldots\ldots(19)$$

the quantity $\alpha_i = \left|\frac{v}{V}\right|$ is the "induced angle of attack" of the wing section. Then, simply, the effective angle of attack of the section of the finite wing is

$$\alpha_e = \alpha - \alpha_i \quad \ldots\ldots(20)$$

The corresponding section lift coefficient is

$$C_L = \frac{2}{\rho V^2 c}\left(\frac{dL}{dx}\right) = a_o\alpha_e$$
$$= a_o(\alpha - \alpha_i) \quad \ldots\ldots(21)$$

where $a_o$ is a constant for the wing section,

(7) Prandtl-Tietjens, *Applied Hydro and Aero Mechanics.*

and $c$ is the chord at any point $x$ along the span. The total drag coefficient of the section of the finite wing is

$$C_D = \frac{2}{\rho V^2 c}\left(\frac{dD}{dx}\right) = C_{Do} + \alpha_i C_L \quad \ldots\ldots(22)$$

The above remarks, with the aid of figure 2, show how simply the lift and drag forces at any section along the span of the wing can be resolved along any two arbitrary rectangular coordinate axes, such as, for example, perpendicular and parallel to the neutral axis of a single spar wing, when the local or effective angle of attack of the section is known.

It has been shown that the velocity potential at any point on the lifting line is multivalued; the discontinuity is

$$\Delta\phi = bV\sum A_n \cos n\theta$$

This is compatible with the existence of circulation about the airfoil section. Indeed Munk has shown that the circulation of velocity has the value[8]

$$\Gamma = 2(\Delta\phi) = 2bV\sum A_n \sin n\theta \quad \ldots\ldots(23)$$

and the intensity of lift

$$dL/dx = \rho V\Gamma = 2\rho bV^2\sum A_n \sin n\theta \quad \ldots\ldots(24)$$
$$= (\rho/2)\, C_L c V^2 = (\rho/2)\, a_o\alpha_e c V^2$$

Hence the effective angle of attack is given by

$$\alpha_e = \left(\frac{4b}{a_o C}\right)\sum_{n=1}^{n=\infty} A_n \sin n\theta \quad \ldots\ldots(25)$$

and the induced angle of attack is

$$\alpha_i = \frac{-v}{V} = \sum_{n=1}^{n=\infty} \frac{nA_n \sin n\theta}{\sin\theta} \quad \ldots\ldots(26)$$

The relation $\alpha = \alpha_e + \alpha_i$ then gives an equation which was obtained by the late H. Glauert[9] using a somewhat different method of solution:

$$\sum_{n=1}^{n=\infty} A_n \sin n\theta\left(1 + \frac{\mu n}{\sin\theta}\right) = \mu\alpha \quad \ldots\ldots(27)$$

where

$$\mu = a_o c/4b$$

At the ends of the wing where $\theta = 0$ (or $\pi$) the last equation takes the particular form

$$\sum n^2 A_n = \alpha \quad \ldots\ldots(27a)$$

(8) Munk, Max, *The Minimum Induced Drag of Aerofoils* (NACA TR. 121).

(9) Glauert, H., *Elements of Airfoil and Airscrew Theory.*

The unknown coefficients $A_n$ may be determined by inserting the values of $\alpha$ and $\mu$ corresponding to $n$ points, $\theta$, along the span and solving the resulting system of simultaneous equations. Before discussing the technique of solving (27), however, we will go further into the matter of forces and moments on the wing. It will next be shown that if the total lift $L$ (or effective angle of attack $\alpha_0$) is known, the value of the coefficient $A_1$ in (27) can be readily determined. From equation (24) we have directly for the total lift

$$L = 2\rho V^2 b(b/2) \int_0^{\pi} \left( \sum A_n \sin n\theta \right) \sin\theta d\theta = \pi q b^2 A_1 \quad \ldots\ldots (28)$$

where $q = 1/2\rho V^2$. But we have also

$$L = q\, C_L\, S = \pi q b^2 A_1 \quad \ldots\ldots (28a)$$

Hence if $C_L$ is the mean lift coefficient over the wing span

$$A_1 = (C_L S/\pi b^2) \quad \ldots\ldots (29)$$

The total induced drag is

$$D_i = \int_0^{\pi} (v/V) dL = \rho b^2 V^2 \left( \sum n A_n \sin n\theta \right) \left( \sum A_n \sin n\theta \right) d\theta = \pi q b^2 \sum n A_n^2 \quad \ldots\ldots (30)$$

By combining equations (28) and (30) it will be found that

$$C_{D_i} = (C_L^2 S/\pi b^2)(1+\delta) \quad \ldots\ldots (31)$$

where

$$(1+\delta) = \left( \sum n A_n^2 \right) / A_1^2$$

It can be shown[9] that $\delta = 0$ for the wing with elliptical planform; therefore, $\delta$ is a factor depending upon the deviation of the particular type of span loading from elliptical. In a similar manner it can be shown that the mean induced angle of attack of the whole wing is

$$\alpha_i = C_L S(1+\tau)/\pi b^2 \quad \ldots\ldots (32)$$

We shall have occasion to employ the important formulas (31) and (32) in connection with the distribution of loads between the individual wings of a biplane.

As a matter of further interest the rolling moment when the lift distribution is unsymmetrical is given by

$$M_x = -\int_0^{\pi} y\, dL = qV^2 b^3 \int_0^{\pi} \sum A_n \sin n\theta (\cos\theta \sin\theta)\, d\theta = qb^3(\pi A_2/4) \quad \ldots\ldots (33)$$

The corresponding induced yawing moment is obtained by integrating the expression

$$dM_y = y(w/V) dL$$

The final result is

$$M_y = -(\pi/4) qb^3 \sum (2n+1) A_n A_{n+1}. \quad (34)$$

In determining the lift distribution of a wing with varying angle of attack and chord along the span, it is convenient to express both chord and angle as functions of ($\theta$) in a trigonometric series. Moreover in a twisted wing the geometrical angle of attack can be expressed in the form $\alpha = \alpha_0 + f(\theta)$ where $\alpha_0$ is the angle of attack at the center. In this it is easily seen that the values of $A_n$ are then obtained from the fundamental equations (27) in two parts, the first being proportional to $\alpha_0$ and the second independent of $\alpha_0$. Thus it is evident that in the general case of a twisted wing the lift distribution may be divided into two parts—(1) one which gives a total lift of zero; (2) the other in which the lift is proportional to the reference angle of attack. It is believed that this method was due first to Wieselsberger[10].

In a subsequent issue of AERO DIGEST the authors will discuss the moment distribution, and will give some important applications of the foregoing theory. It is also the authors' intention to discuss an accurate method of distributing the air forces and moments over the individual wings of the biplane.

10) Wieselsberger, C., *Theoretical Investigation of the Effect of the Ailerons on the Wing of an Airplane* (Aero. Research Inst., Tokyo Imperial Univ., No 30, Vol. II).

# Digest of Technical Articles from Foreign Publications

## Aerodynamic Research

*Construction and Use of an Industrial Wind Tunnel (La Construction et l'Utilisation d'une Soufferie Industrielle; Robert Boname; L'Aeronautique, No. 207; Août* 1936.)

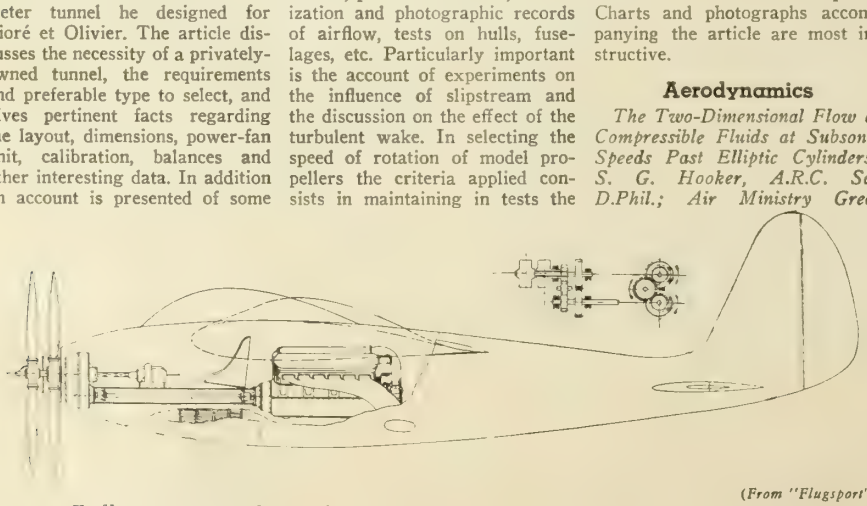
Mr. Boname describes the 2-meter tunnel he designed for Lioré et Olivier. The article discusses the necessity of a privately-owned tunnel, the requirements and preferable type to select, and gives pertinent facts regarding the layout, dimensions, power-fan unit, calibration, balances and other interesting data. In addition an account is presented of some of the author's experiments on stability with and without slipstream, power of controls, visualization and photographic records of airflow, tests on hulls, fuselages, etc. Particularly important is the account of experiments on the influence of slipstream and the discussion on the effect of the turbulent wake. In selecting the speed of rotation of model propellers the criteria applied consists in maintaining in tests the same value of the ratio of slipstream speed to speed of advance as that of the actual airplane. Charts and photographs accompanying the article are most instructive.

## Aerodynamics

*The Two-Dimensional Flow of Compressible Fluids at Subsonic Speeds Past Elliptic Cylinders; S. G. Hooker, A.R.C. Sc., D.Phil.; Air Ministry Great Britain; Aeronautical Research Committee Reports and Memoranda No.* 1684; *November,* 1935

Only the case of the fluid streaming past the cylinders in the direction of their major axes is considered in this paper, and due to the necessity for expanding a certain function in the analysis, the fineness ratio of the ellipse to which the theory can be applied is limited.

Since actual experimental data for elliptic cylinders is lacking, the measurements made by the late Sir Thomas Stanton for the front portion of a symmetrical Joukowski airfoil are used to check the theoretical conclusions. Calculated effects of air compression upon the minimum pressure are in good agreement with those observed up to about one half of the speed of sound. For higher speeds the observed effect is much greater than that predicted by theory, and it is shown that the divergence between the two does not correspond with the attainment of the local speed of sound by the air on the airfoil's surface. (*Continued on page* 56)



(*From "Flugsport"*)

***Koolhoven F.K. 55 Fighter with extension engine shaft, two propellers and machine gun***



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Wright Cyclones have completed over 1,000,000 hours of operating experience on leading airlines throughout the world—a record unapproached by any other builder of aircraft engines of similar horsepower.

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*"Fly With Wright the World Over"*

# WRIGHT

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# Specially-Designed Work Stands Assist in Airline Maintenance



● Accelerated schedules and the ever increasing traffic make airline maintenance a battle against time. With demands for more seats waiting arrival of the new and larger equipment, the airlines must speed up maintenance procedure so that the equipment is back on the line with little delay.

Servicing and overhaul requirements are as strict today as always, maintenance experts keeping airliners in condition by utilizing every generally-available mechanical device, in addition to their own specially-designed equipment to meet the particular maintenance requirements of the modern air transport.

Servicing the all-metal skyliner differs considerably from the systems used in the maintenance of other transport vehicles. For example, an aircraft mechanic cannot walk all over a transport plane like a railroad mechanic climbs over a locomotive in the round house.

In order that proper servicing can be given to the different plane parts in the quickest time commensurate with safety and thoroughness, a number of service stands have been designed and used advantageously. Those used by Transcontinental & Western Air, Inc., are made in the company's shops. They not only facilitate the servicing of TWA Douglas transport planes, but each is another step toward increasing efficiency and reducing the costs of maintenance work.

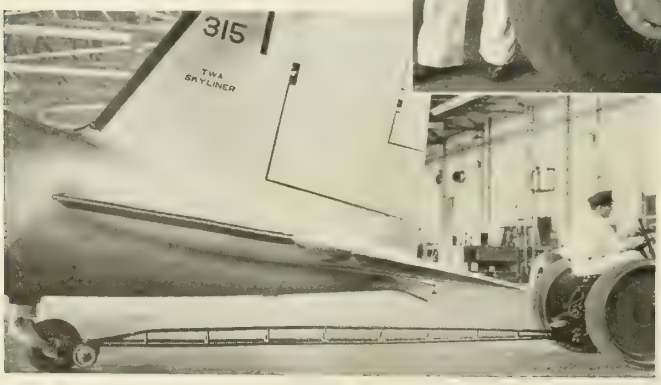
Light in weight to permit easy handling, these stands are readily moved about the shop. They are of steel tubing to provide the strength necessary to support several mechanics and their equipment with a wide margin of safety. Rollers on the larger stands permit them to be jockeyed to the correct position alongside the transport which, once in the maintenance hangar for its periodic overhaul, is not moved out again until the work has been completed, the plane tested and made ready to resume service.

The stand used for checking, removing or installing the rudder on the TWA skyliners is unique in design as well as in purpose. It can be placed at the footing desired without interfering with movement of the tail surfaces of the plane. As such a purpose alone is limited, the stand has been designed to permit it to be used for other ordinary work. As a tail inspection stand, a padded member rests on the stabilizer. When not required for this purpose, an auxiliary tubing frame is inserted in the gap between the uprights provided for the elevator clearance; thus revised, the stand can be used in the same manner as other platforms for general maintenance work. It is provided with four broad work steps, two noncastering wheels and two fixed legs.





*Landing gear tripods, nacelle stand and tail wheel tow fork*



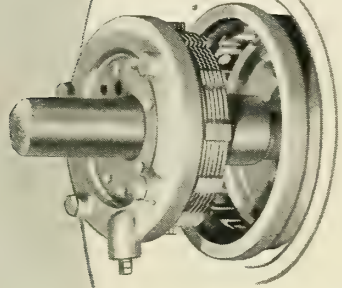

In order to support the plane in such a way that the landing gear may be retracted and lowered, a simple stand with a telescopic adjustable main leg, is fitted next to the two engine nacelles. The plane is lifted by a hoist while the two tripods are bolted to fittings on the underside of the center section. The plane is lowered until it rests on the tripods.

When outer wing panels are removed from the center section, a pair of steel tube stands are bolted to the wing fittings in the same manner that the wing panel is attached to the center section. The stands are on casters and are of the correct height to enable handling and repair work to be done conveniently.

(*Continued on following page*)

# LIGHTNESS *Leads*

**TO GREATER PAYLOAD CAPACITY!**





The wheel and brake castings of the Goodyear Airwheel are entirely of Dowmetal. Here, where Dowmetal meets the demand for extreme lightness, it also demonstrates its exceptional strength in withstanding the most severe landing stresses and landing conditions.

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In such products as foundry flasks, portable power tools and the famous Hoover Electric Cleaner it makes manual handling far easier. In air conditioning systems, bread wrapping-slicing machines, textile looms and presses, it gives equivalent or speedier operations with far lower power costs.

But, a front-rank value of Dowmetal is its contribution to larger payloads. For the past several years it has demonstrated its signal value in the field of aircraft. Today it is showing builders and users of trucks and buses how it can cut dead weight and greatly increase payload capacity.

Available in plate, sheet, forgings, sand or die-castings, standard and special extruded shapes, Dowmetal is ready to go into a variety of applications.

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DOWMETAL

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LIGHTEST OF ALL STRUCTURAL METALS

(*Continued from preceding page*)

The stand for work on the nose of the Douglas provides 18 square feet of platform space, giving comfortable and substantial footing to the mechanics assigned to check and maintain the instruments and controls inside the shell of the nose section. One side of the platform is provided with pads which rest against the body of the ship, and a cut-away notch in the floor gives clearance for the lower radio antenna mast. It has four rubber-tired caster wheels, an inclined integral ladder and hand rails. Adjustable screw legs with hand cranks are provided at each of the four corners of this stand. By their use, the stand may be slightly raised from the floor and fixed so it will not roll out of position. It also permits the stand to be set true in the event that the floor is not level.

Another effective type of work platform has been designed for the mechanic who works inside the engine nacelle. Sufficiently large to accommodate two men, the upper member of this stand hooks on to a cross member of the landing gear structure, above the wheel; lower members rest against the oleo landing gear struts. By using this stand the mechanics have easy access to the wheel retracting mechanism situated within the wing structure. Many of the fuel and electrical lines between the nacelles and pilots compartment are located in this region, also, rendering their inspection, repair, adjustment or replacement more convenient than possible heretofore. When work is completed, the mechanic merely lifts the stand out of place.

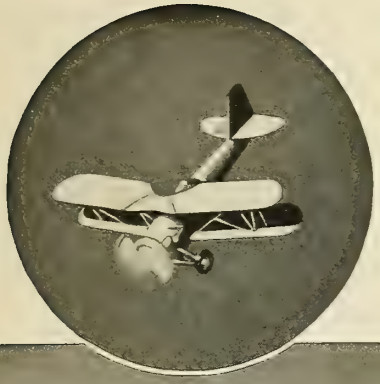


A horizontal steel tube frame is used as a tow-fork. The fork end is attached to the tail wheel axle and the other end fits into a clamp on the rear of a tractor. It is formed of three long tubes with triangular braces spaced equally throughout its length. When not attached to the plane, one end rests on a pair of pressed steel wheels having solid rubber tires. Through the use of this device, a plane is moved about with safety, the rods being of sufficient length to permit the tractor to maneuver with no danger of touching the elevators.

Many items of smaller and useful equipment usual in maintenance work, may be made of tubular steel, welded. For example, light two-wheeled carts for carrying storage batteries to and from the planes and also various types of wheel chocks. The latter are often made of scrap pieces of round or square steel tube.




*Service work stands of welded tube especially designed for use from nose to tail on the Douglas DC-2*



# For that Added Margin of Safety...



## SHELBY *Seamless* AIRCRAFT TUBING

THERE can be no compromise with safety in aircraft construction — no substitute for pre-determined reliability. For all the skill of designer and builder may go for nothing if their materials fail them. Rigidity, fine balance, that added margin of safety, depend absolutely on the sturdiness of the tubular frame.

SHELBY Seamless Aircraft Tubing is the natural solution to this vitally important problem of framework construction. The light weight, high tensile strength, uniformity and durability of this superior steel tubing offer both designer and builder a service-tested material that combines maximum safety with lightness and superior strength. Its production is constantly safeguarded to maintain reliability. Every foot of SHELBY Seamless must pass through an intensive system of testing and inspection. Both physical and chemical properties are made to conform to the United States Army and Navy specifications.

Made by America's largest and most experienced manufacturer of mechanical tubing, SHELBY Seamless is available in chrome-molybdenum, mild carbon and stainless steels, both round* and streamline sections. Quick delivery from stock is assured by distributors located at convenient points throughout the country. And these stocks are carried in specific lots so that actual test reports which accompany shipments can be furnished for each lot at time of delivery.

* Round Tubing is also available in SHELBY "BF" Aircraft Tubing, which has an improved bright outside finish.

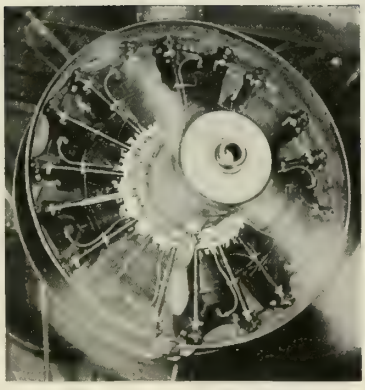
## NATIONAL TUBE COMPANY

PITTSBURGH, PA.

Columbia Steel Company, San Francisco, *Pacific Coast Distributors* · United States Steel Products Company, New York, *Export Distributors*

UNITED STATES STEEL

# 1220 hp Wright G-100 Cyclone Engines for Commercial Airlines



● The most powerful single-row radial engine in the world was demonstrated at the Wright Aeronautical Corp. plant in Paterson, N. J., recently. Known as the G-100 Cyclone, this engine is a development of the 1000 hp Series G Cyclone which is now being used in military and commercial service.

Developed for commercial airline use, the G-100 Cyclone produces 1220 hp at 2400 rpm and incorporates a reduction gearing set at 16:11. Although capable of producing 1220 hp for take-off, these engines are rated 1100 hp for take-off and 41 of this type have been purchased by Transcontinental & Western Air for use in the Super Douglas Skyliners now being completed at Santa Monica. The new Skyliners will use a maximum of 1000 hp for take-off and 550 hp, or 45% of the available power, for cruising operations. This is all the power needed to maintain present TWA coast-to-coast schedules of 15 hours 23 minutes. Output of the G-100 will be 950 hp at 5200 ft.

Development of the advanced Cyclone has been carried on in the experimental laboratories of the Wright company for the past 12 months. While many new features have been incorporated in the design of these engines, all have been thoroughly tested as units in the 1000 hp Cyclones for the Army Air Corps.

Refinement in design of the newest Cyclone is the forged steel main crankcase section which replaces that of aluminum alloy previously used. Although weighing about 30 lbs. more than the previous crankcase, the steel unit, the first of its type employed in a production aircraft in this country, is 50% stronger than cases of aluminum alloy.

To insure longer life and improve operation of the parts involved, cylinder head design has been improved and its height increased .437 in. to provide for a longer piston which permits better cooling of the piston head and a greater bearing surface on the piston skirt.

Following G-Series practice, the cylinder barrel of the G-100 is nitrided to obtain a cylinder bore that will insure maximum service and reliability. Nitrided cylinder barrels have been found to be three times as hard as the conventional heat-treated cylinder barrel.

Valve design of the new Cyclone has been refined to provide for better flow of the incoming mixture and outgoing exhaust gases. Lubrication of the valve gear is accomplished through a built-in system, devoid of external lines or tubes.

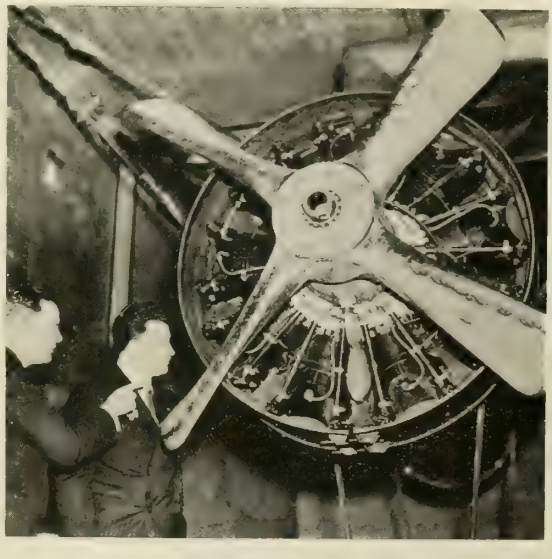
A new type and lighter-in-weight carburetor has been developed for the G-100 Cyclone. It is not only impervious to effects of icing, but also provides automatic compensation for variation in operating altitude without utilizing complicated automatic mixture control devices. Simple in construction, the new carburetor is so designed that it eliminates the necessity for a large air heater to avoid ice formations.

Refinement of the dynamic damper counterweight also has been accomplished. Other improvements in the new engine include further development of the 11-in. supercharger impeller, connecting rods of new design required by the increased power output, improved drives for constant speed propeller governor, vacuum pumps for operation of retracting gears, gyropilots and navigation instruments, and a new priming system which facilitates cold weather starting. This latter development has been worked out with the cooperation of the U. S. Army Air Corps. Aside from these innovations, construction and details of the new engine are similar to the G-Series Cyclone which was described in the September 1936 issue of AERO DIGEST.

Although at 1275 lbs. the new Cyclone weighs about 110 lbs. more than the 1000 hp G, an additional 220 hp is available, thus attaining greater power at an increase of only about .5 lb./hp. At cruising speed, the G-100 shows a specific fuel consumption of .43 lb./hp, a figure which closely approaches that of the Diesel. Provided with the 16:11 reduction gearing, weight/hp of the new engine is 1.05 lbs.

The new Cyclones are being tested in a new $100,000 test building which has just been completed. Completely soundproofed and provided with the most modern devices and instruments for test work, this building is so equipped that, if necessary, engines delivering up to 2500 hp can be tested.

An innovation in test rooms is the method of suspending the engine from cables. Situated on a hydraulically-operated test stand, the engine is elevated about 8 ft. for operational purposes, but if necessary it can be lowered for inspection, maintenance or adjustment from a stand equipped with telescoping sections which provide a cat-walk arrangement around the engine.



*Wright G-100 Cyclone suspended in the new hydraulically-operated test stand capable of accommodating engines up to 2500 horsepower*




**CURTISS-WRIGHT CORPORATION**

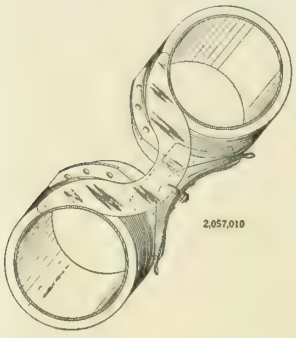
**CURTISS AEROPLANE DIVISION**

**BUFFALO · NEW YORK**

# Recent Aeronautical Patents

● The following recent patents of interest to readers of AERO DIGEST were compiled from the Official Gazette of the United States Patent Office.

Baffle for air-cooled cylinders.




Roland Chilton, Ridgewood, N. J., assignor to The Reed Propeller Co., Inc. (2,057,010)

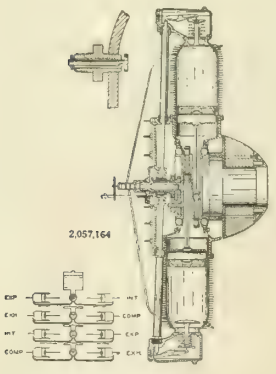
Means for Balancing and Strengthening of Ocular Muscles and Developing Fusion. Robert W. Smith, Kansas City, Mo. (2,057,066)

Variable Electric Condenser. Arthur Hammer and Erich Schäfer, Berlin, Germany, assignors to Telefunken Gesellschaft für Drahtlose Telegraphie, m.b. H., Berlin, Germany. (2,057,097)

Airplane wing structure. Pierre Ernest Mercier, Paris, France. (2,057,339)

Engine starting mechanism. Francis Linder, E. Orange, N. J., assignor to Eclipse Aviation Corp. (2,057,386)

Internal combustion engine.




Hugh M. Rockwell, Freeport, N. Y. (2,057,164)

Combustion engine and the like. John T. H. Dempster, Schenectady, N. Y., assignor to General Electric Co. (2,057,560)

Elastic boat, particularly applicable to seaplane floats. Richard Hopp, Berlin, Germany, assignor to Reginald William Allott, Yorkshire, England. (2,057,574)

Radio communication system. Frank Conrad, Pittsburgh, Pa., assignor to Westinghouse Electric & Manufacturing Co. (2,057,640)

Pneumatic airplane seat. Frank G. Manson, Dayton, Ohio. (2,057,687)

Airplane and parachute connecting device. Richard N. Williams, U. S. Navy. (2,057,699)

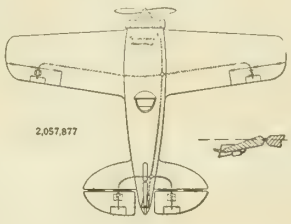
Piston. Auguste Louis Rene Bernard, deceased by Renee Bernard, executrix, Paris, France. (2,057,758)

Double window construction. Henry J. Galey, Tarentum, Pa., assignor to Pittsburgh Plate Glass Co. (2,057,823)

Valve construction. Marion W. Sullins, Toledo, Ohio, assignor to Thompson Products, Inc. (2,057,858)

Multiple pump particularly for reversible flow systems. Francis Victor Brown, London, England, assignor to Automotive Products Co., Ltd. (2,057,934)

Automatic torque control for




aircraft. Clarence A. Bragunier, Los Angeles, Calif., assignor of one-half to Martin Daniel King. (2,057,877)

Engine mount. Herbert A. Whitaker, Hartford, Conn. (2,057,990)

Magnetic compass. George DeBeeson, Glendale, Calif., assignor by mesne assignments to Kormann Aero-Safety Appliance, Inc. (2,058,004)

Means for Automatically Recording and Reproducing Telephonic Messages. Leopold Neumann, Vienna, Austria, assignor to Telefonograf-Patentverwertungs-Gesellschaft m.b. H., Vienna, Austria. (2,058,096)

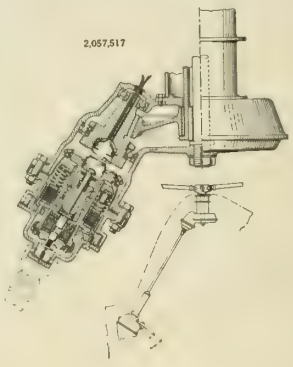
Propeller. Anthony Assala, Des Moines, Iowa. (2,058,122)

Control mechanism for aircraft. Paul M. Lewis and Fred Landgraf, Denver, Colo., assignor to Lewis-American Airways, Inc. (2,058,161)

Artificial Larynx. George W. Burchett, Peekskill, N. Y., assignor to Bell Telephone Laboratories, Inc., New York, N. Y. (2,058,212)

Aircraft flotation device. Daniel Mapes, Upper Montclair, N. J., assignor to Walter Kidde & Co., Inc. (2,058,244)

Driving mechanism for aircraft




parts. Martin J. Finnegan, New York, N. Y., assignor to Eclipse Aviation Corp. (2,057,517)

Internal combustion engine. Frank C. Mock, E. Orange, N. J., assignor to Bendix Aviation Corp. (2,058,487)

Floodlight reflector. George Arras, Chicago, Ill. (2,058,548)

Apparatus for preventing back flash in gas lines. Phillip S. Williams and Oliver W. Johnson, Palo Alto, Calif. (2,058,650)

Ventilation for airplanes. Giuseppe M. Bellanca, New Castle, Del. (2,058,659)

Flying machine. Verne Keith Fry, Noble Township, Ind. (2,058,678)

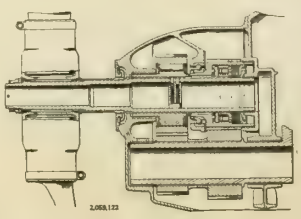
Stop clock. William Muir, Bristol, and Herbert Snow, Burlington, Conn., assignors to the H. C. Thompson Clock Co. (2,058,712)

Clip for mounting tubes, etc. Emmett Quimby Smith, Detroit, Mich. (2,058,733)

Control for vessels (airships). Wolfgang B. Klemperer, Silver Lake, and Herman R. Liebert, Akron, Ohio, assignors to Goodyear-Zeppelin Corp. (2,058,803)

Internal combustion engine of the liquid fuel injection compression ignition type. Harry Ralph Ricardo, London, England (2,058,827)

Propeller. Raymond P. Lans-



ing, Montclair, N. J., assignor by mesne assignments to Eclipse Aviation Corp. (2,059,122)

Boat hull. John C. Whitesell, Jr., Norristown, Pa., assignor to Edward G. Budd Manufacturing Co. (2,058,282)

Robot navigator. Frederick A. Fowler, Nevada City, Calif. (2,058,306)

Hollow rivet. William E. Meissner, Newark, N. J. (2,058,338)

Piston. Harold H. Dillon, Cleveland, Ohio, assignor by mesne assignments to Cleveland Trust Co. (2,058,424)

Attachable washer. Samuel K. Hoffman, Williamsport, Pa., assignor to Lycoming Manufacturing Co. (2,058,452)

Propeller clamping and balancing ring. John E. Larason, Dayton, Ohio. (20,159 reissue)

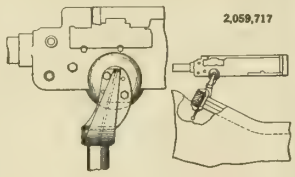
Fire extinguishing system. Scott E. Allen, Glen Ridge, N. J., assignor to C-O-Two Fire Equipment Co. (2,059,190)

Device for melting sleet and ice on windshields. Howard Edwin French, Clinton, Conn. (2,059,224)

Ignition system for internal combustion engines. Harry E. Kennedy, Berkeley, Calif. (2,059,243)

Spark plug. William E. Letterman, Seattle, Wash. (2,059,257)

Flexible adapter for machine




guns. Clem G. Trimbach, Kenmore, N. Y., assignor to Curtiss Aeroplane & Motor Corp. (2,059,717)

Gyro horizon indicator. Francis Glen Nesbitt, Dayton, Ohio. (2,059,266)

Anti-vibration mounting for instruments. Leslie F. Carter, Leonia, N. J., assignor to Sperry Gyroscope Co., Inc. (2,059,313)

Radiogoniometer. Henri Chireix, Paris, France, assignor to Compagnie Generale de Telegraphie Sans Fil. (2,059,315)

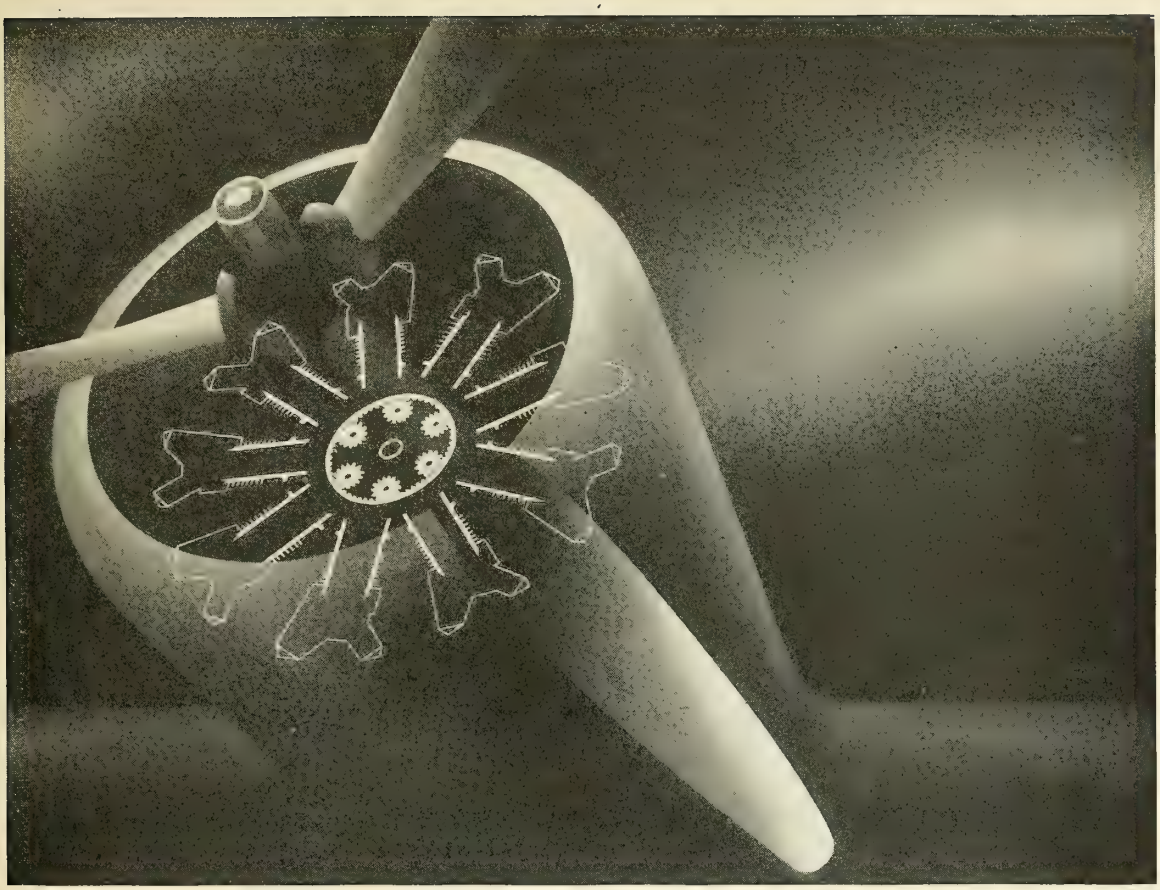
Fuselage. Jan Rouffaer, Oakland, Calif. (2,059,492)

Revolving wing aircraft. Herman Klatt, Pueblo, Colo. (2,059,528)

Inclinometer. Emil Christensen, Portland, Ore. (2,059,551)

Aircraft. Antonio V. Santarsiero, New York, N. Y. (2,059,610)

Deicing throttle. Rudolph F. Gagg, Fairlawn, N. J., assignor to Wright Aeronautical Corp. (2,059,687)



# Where DEPENDABILITY is vital

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Dependability is the primary reason why Molybdenum nitriding steels are used for such vital engine parts as cylinders, ring gears and drive gears. For example: They depth-harden uniformly in varying sections. They can be nitrided at the most effective temperature for producing a hard, wear-resisting case; show minimum distortion after heat treating; retain their properties at elevated temperatures.

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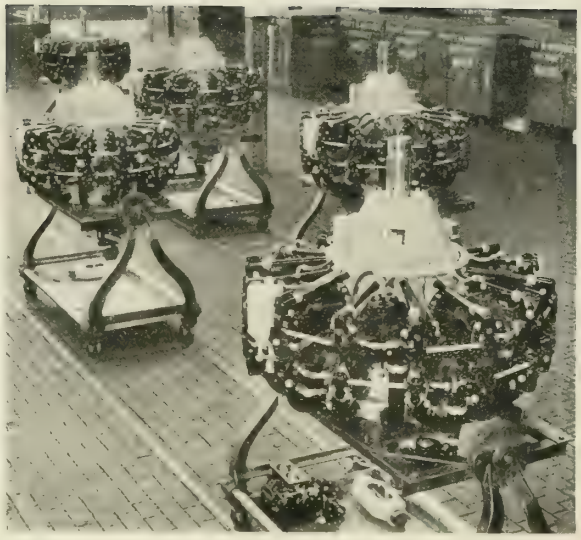
**Climax Mo-lyb-den-um Company**

MOLY

# CHARACTERISTICS OF THE TWO-ROW RADIAL ENGINE

ROBERT INSLEY

Asst. Director of Research, United Aircraft Corp.



**Some seven years ago the engineers of Pratt & Whitney Aircraft started their two-row aircraft engine development program. The first results of that program, the Twin Wasp and Twin Wasp Junior engines, were put into regular production in 1934 and have seen sufficient service to permit evaluation of their virtues in comparison with the single-row engines of similar mechanical construction.**

● Like the single-row Wasp and Hornet types, the Twin Wasp and Twin Wasp Junior engines are mechanically identical, differing only in the size of parts to accommodate their difference of displacement of 1830 and 1535 cubic inches respectively and, except for differences in crankshafts, master connecting rods, and cam mechanisms, they are of the same general construction as the single-row P & W engines.

The two-row engines have 14 cylinders arranged in two staggered rows of seven each. The cylinders of the front row, together with their valve gear, resemble closely the cylinders of the single-row engines, while for the rear cylinders the cams and valve gear are behind instead of in front, with corresponding modifications in the cylinder heads. Reduction-gear and accessory-drive assemblies are similar to those of the single-row engines. The engines differ, therefore, only in the essential features of the two types and comparison of their service records should provide a reliable indication of their relative advantages or disadvantages.

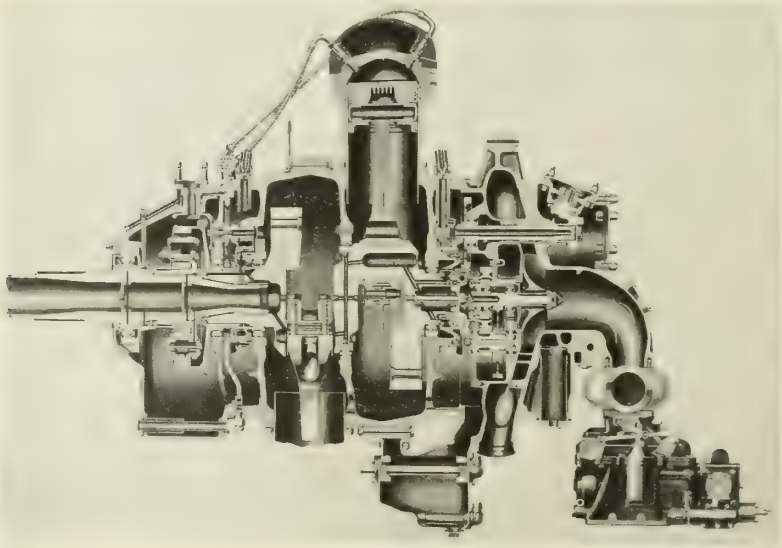
Although the objects in mind in the development of the two-row engines were principally small diameter and smoothness, these engines do not suffer noticeably in other respects. It might be expected, for example, that an engine with two crank throws, two rows of cylinders, and other corresponding parts in duplicate would be appreciably heavier than a single-row engine, yet the Twin Wasp Junior in pounds per cruising horsepower is less than 10% heavier than the Hornet engine of substantially equal power. Early fears that good mixture distribution might be difficult to obtain in the two-row engine or that its mechanical efficiency might be low have not been realized. As a matter of fact service records tend toward slightly lower specific fuel consumptions for the two-row engine than for the single-row.

In common with internal combustion engines in other fields, the two-row radial aircraft engine exemplifies the improvements in operating characteristics which follow from an increase in the number of cylinders. One of these operating improvements is, in general, smoothness and freedom from vibration. Thus with the two-row engine, the effects of repeated stresses on the airplane structure are minimized, with consequent diminution in maintenance difficulties and in the detrimental consequences of transmitted vibration. This last circumstance means not only more comfort for the passenger but also more reliable functioning of instruments and auxiliary equipment.

The fact that the two-row has more and smaller cylinders than the single-row engine results in a second advantage—a reduction in the propeller stresses produced by the explosion impulses. As these stresses are often the critical ones in determining the sizes of propeller parts, the result is that for a given engine power and propeller speed the weight of the propeller for the two-row engine may safely be less than that for the single-row engine.

Service experience has supported the

(*Continued on following page*)



*Longitudinal section showing interior construction of the Twin Wasp*

*Pan-American Clipper above San Francisco Bay. (In California, 237 Boeing School graduates have secured positions with lines and factories.)*



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(*Continued from preceding page*)
belief that the two-row engine is less noisy than the single-row engine of equal power, due partly to the smaller cylinders, with resulting decreases in the energy of the individual exhaust impulses, and partly to the higher frequency of the exhaust pulsations which make the noise less objectionable in character.

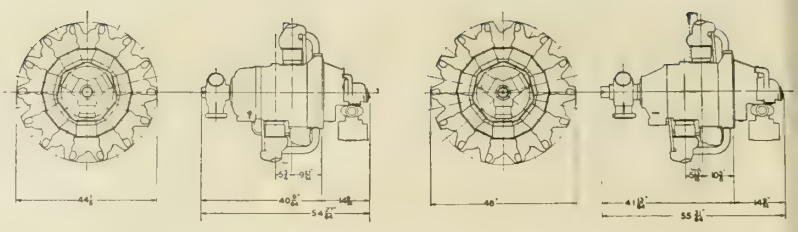
It is inevitable that in equal power and in equal production quantities the two-row engine must be more expensive to manufacture than the single-row type, because it contains more parts and consequently involves more labor. The ratio of costs, however, is considerably less than the ratio of the number of cylinders and even in present production quantities the ratio of selling prices is below that ratio. Here, however, it should be mentioned that the use of smaller cylinders and the smooth-running characteristics of the two-row engine warrant the expectation both of a longer total life and of longer intervals between overhauls than in the case of the single-row engine, thus to some extent offsetting the difference in first cost and in the cost of individual overhauls.

In the servicing required from day to day, the difference between the single-row and the two-row engines is less than might be expected, chiefly because this servicing has consisted largely of valve gear lubrication. The development of the automatically lubricated gear has diminished this item of labor so much, both for the single-row and for the two-row engines, that the difference in this respect between them is relatively small.

When the development of large two-row engines was first undertaken, it was feared that it might prove difficult to cool the rear cylinders adequately. However, the contemporaneous development of the close (pressure-type) baffle so reduced the quantity of air required for cooling that it has become relatively easy to insure to the rear cylinders an adequate flow of air that has not been heated by contact with the front cylinders. Another recent development in engine cooling, the controllable cowl, has made it possible to obtain an adequate total flow of air, even under difficult conditions, such as in climb, and at the same time to reduce both the air flow and the resulting drag under the easier cooling conditions of cruising.

Dimensional relations between the cylinders of single-row and those of the two-row engines tend toward inherently better cooling characteristics for the latter, since in relation to heat to be dissipated more cooling surface is available in the smaller cylinders than in the larger ones. Therefore, in actual service with equally up-to-date cooling equipment, the two-row engines involve no greater cooling difficulty than the single-row type.

Although overall length of the two-row engine is somewhat greater than that of the corresponding single-row, this advantage is offset by a reduction in overall engine diameter, which, in a typical case, amounts to about 20%.

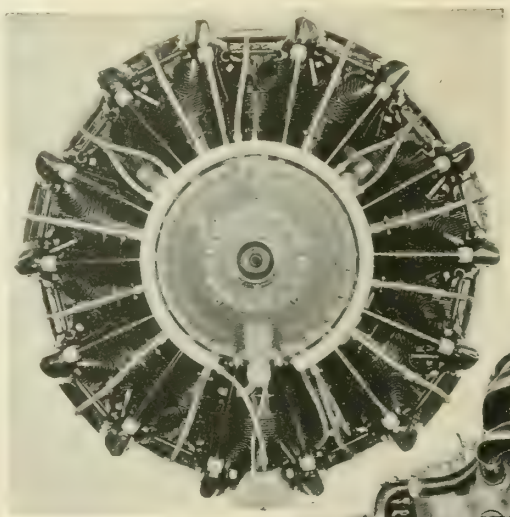


*Dimensions of the P. & W. Twin Wasp Junior and the Twin Wasp engines*

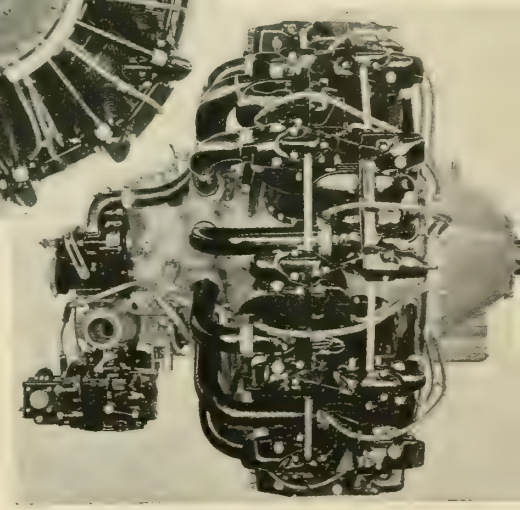
Several favorable characteristics of the two-row engine are due to this small overall diameter. One of the most apparent is improvement in visibility, especially in single-engine machines. Another consequence of the smaller diameter of the two-row engine is a reduction in engine drag, the effect of which on airplane performance depends on the design of the airplane; it is greatest in fast machines of clean design, especially those with small fuselages or nacelles, and is least in airplanes of such design that engine drag constitutes a relatively small part of total drag.

A third effect of the reduced diameter of the two-row engine is an improvement in propulsive efficiency, assuming, of course, that both the single-row and the two-row engines have geared propellers. For a typical case, this improvement in propulsive efficiency amounts to about 2%, both at maximum and at cruising speeds, thus diminishing by that amount the fuel required for a flight of given distance at a given airplane speed. Alternatively, the improvement in propulsive efficiency may be utilized to increase the airplane's maximum speed.

An incidental advantage of the small diameter of the two-row engine is that it offsets the effect of the larger number of cylinders on the weight of cooling baffles and of exhaust collector. Therefore the combined weight of cowling, baffles, and exhaust collector is no greater for the two-row engine than for the corresponding single-row.



*Front view of the 1000 hp Pratt and Whitney Twin Wasp double-row engine*



*A direct side view showing arrangement of the latest model P. & W. Twin Wasp*

# UNITED AIR LINES'

**new $3,000,000 fleet equipped with**

# MACWHYTE AIRCRAFT CABLE



One of the 28 new Douglas twin-engined transports built especially for United Air Lines' New York-Chicago-California route. All planes have the finest equipment, including Macwhyte Aircraft Cable for controls.

Macwhyte salutes this new standard in fast, comfortable air travel! We are proud of the part we have played in equipping this great new United Air fleet.

Macwhyte Aircraft Cable is precision made in our own plant on special aircraft cable machines. This modern equipment is used for making both *PRE*formed and non-preformed cables. Manufacturing operations are under the close supervision of metallurgists and engineers. Tension, torsion, bending, fatigue and corrosion tests are constantly made in accordance with the latest A-N specifications in order to produce the most dependable, longest-wearing cable possible. *Write for Aircraft Cable Folder.*

**Macwhyte Tie Rods**

- *Streamline*
- *Square*
- *Round*

Made in accordance with A-N specifications to meet all tensile, bending and salt spray requirements.

AD NO. 259

**Three Constructions**

| 1 x 19 Non-Flexible | 7 x 7 Flexible | 7 x 19 Extra Flexible |
|---|---|---|



# MACWHYTE COMPANY

Kenosha, Wisconsin · Specialists in the manufacture of Cable, Tie Rods and Braided Wire Rope Slings for Aircraft

# Personalities

by Caldwell

● I've been writing these little histories of pilots for a decade or so, and every now and then I'm asked the same old question: "Do you know all these birds? Or do they write in about themselves, and you write 'em up from that?" If I've been asked that once, I've been asked it 200 times. I'm tired of the question, so I'll answer it in print, and be done once and for all with a query that has become a major problem in my life.

Yes, I know probably 95% of the boys I write about, and usually quite a bit about them, in a general way. Then again, I may meet them some place and have a chat, or just write them and tell them I'd like to do a little piece about them, and for them please, in a co-operative effort to keep me eating without working, send me the places and dates and main facts, and any little incidents in their careers, and I'll add what I know—and there you are. Sometimes friends of mine will write in and say, "Why don't you write up Crasher Hard—here's the facts about him." So, if I have confidence in my correspondent, I'll write up the stuff and send it to Crasher to find out if it's really his life, or if some foul Corsican has simply been kidding me. For instance, one malicious egg sent me a fancy biography of Jack Berry, of Cleveland Airport, telling about Jack shooting down half a dozen Germans and a box of clay pigeons, and so forth, when of course the old boy hadn't done any such things, as I knew. For those recent sketches of Air Mail pilots awarded the Medal of Honor, I had my friend Dave Behncke write and ask them to help me out, which most of them kindly did. And right here I want to express my sincere appreciation to all who have aided me with this series—people have been nice to me, and I don't deserve it.

You may recall that recently I commented on Karl Ort and his famous catalogue that amused me so much? Well, I got a note from him saying: "I appreciate the write-up you gave me in AERO DIGEST. I don't need to tell you that I'm not much different from a lot of other people: I like to see my name in print. In fact, I often pay out my own good coin to do just that, and the results I receive from some advertisements pay me to do it." Well, I naturally replied, "All right, then—you owe me a favor—your complete biography." As this was the first time old Karl had ever been offered space for nothing, he not only seized the opportunity, such as it is, but he wrote his own biography in the same style of writing that he knew I'd use if I did it myself. He must have been reading me for years, for he has copied little tricks and mannerisms of writing that I've fallen into through the ages. If he had handed it to me and told me I had written it myself years ago, and had forgotten doing it, I'd have believed him. So here it is, just as he wrote it, but with some little changes here and there—for I have to get in a few jokes on him on my own account:



*Karl (K.O.) Ort*

Karl Ort was born Dec. 19, 1896, at York, Pa. Karl isn't very big even now, but on Dec. 19, 1896, he was so insignificant as to be practically whimsical. Hearing little Karl yelling one day, Mrs. Ort rushed to his cradle and found the cat dragging him off—evidently under the impression that it had caught a diapered mouse. Thereafter his mother took no chances, but anchored Karl to his crib by tying him to a flat-iron. This infuriated and baffled the cat, but preserved the infant to grow up into the man he is today. Some people have held this against the cat.

In spite of every care by his indulgent parents, Karl gradually grew up—there was no stopping him until he'd got to five feet or so. He showed early promise by engaging in the shaved ice and snowball business at the age of seven, but the vagaries of Pennsylvania weather made that business almost as uncertain as his present one—airplane supplies, materials and accessories—see Advertisement, if any. Another indication of budding business ability was that between the ages of 9 and 14 he got paid for going to church—he got a job in the choir, receiving 75 cents a month for six appearances each week. This experience taught Karl that it pays to be good—but doesn't pay much. He has never forgotten that.

In the choir he met Agnew Larsen, now vice-president and engineer of Pitcairn Autogiro Co. Agnew used to buy copies of an aviation magazine, for at that time AERO DIGEST was not available. Anyhow, by reading that magazine, Karl got the ambition to become an aviator, of all things; and the usual rash of ambitions to be a fireman, policeman, engineer, or Northwest Mountie fell away like scales, leaving him an under-sized youth with an over-sized ambition to go out and fly like the birdies fly. But it cost $400 to go to the Curtiss School at Norfolk—and Karl was still trilling for the Lord at a monthly stipend of 75 cents.

He graduated from high school in 1914, spent a year hunting and trapping, and found that there was exactly $15 worth of furs around York, Pa. He was still $385 short of the tuition in 1915, with a war raging in Europe, and rich men's sons dashing off in Ambulance Corps to pick up the casualties and week-ends in Paris. But it cost $600 to join an Ambulance Corps, and Karl's assets were $14.75. He made a detour, via DuPont Powder Company's Haskell, N. J., smokeless powder plant, where he accumulated sufficient money to pay his own way to Plattsburg Training Camp. The day after he left, the powder plant blew up—which leads me to the conclusion that Karl had been there as a mascot, and the plant's luck had gone with him to Plattsburg, where he learned to march with full pack, shoot and fall back, form fours, right turn, and how to build latrines. Karl also learned one important fact—how to get out of the infantry while the getting was still good. So off to Essington, Pa. for Air Corps examination. They examined what there was of him, and found it just a trifle short. Karl told them to file his papers, and he'd be back later. He took a course as a street car conductor at a seaside resort that summer and stretched himself out so ringing up fares for the company and himself that he gained inches. By that time war had been declared and the social and athletic bars were down—they were taking anyone who could walk and not run if shot at.

Finally he now went to Princeton ground school, then to Love Field, Dallas, where a group of budding pilots had the dubious privilege of assembling and rigging their own Jennies and Standards, which often resented this amateur handling by spinning in, or even refusing to go up at all. Karl thought the trouble was the density of the air. He finally got to Hoboken—to learn that the transports had room only for Y.M.C.A. workers and Elsie Janis. No room for aviators, so Karl was sent to San Diego, apparently to see if he could get to the war by way of Cape Horn. By that time the Germans were tired of waiting for him and sued for peace. Thus by trying hard to get into the war and by refusing to wear an influenza mask—remember them?—Karl escaped not only the war but the influenza.

The Government had a problem: what to do with their surplus pilots. The pilots had a similar problem: what to do

(*Continued on following page*)




Hamilton Standard Propellers are now occupying their new plant—into which has been designed every aid to efficient manufacturing. This — the largest propeller manufacturing plant in the world — provides the additional space and facilities necessary to meet the increasing requirements of customers throughout the world.

HAMILTON STANDARD EAST HARTFORD CONNECTICUT DIVISION OF UNITED AIRCRAFT CORPORATION PROPELLERS

**HAMILTON STANDARD PROPELLERS**

**DIVISION OF UNITED AIRCRAFT CORPORATION · · · EAST HARTFORD, CONN.**

(*Continued from preceding page*) with themselves. The problem was solved by permitting the pilots to buy or swipe all the Jennies and Standards in stock, and thus splatter themselves and some incidental passengers over the landscape. This is what is now referred to, with wistful sighs, as the beginning of commercial aviation in America; the pilots are mentioned, if at all, as noble pioneers—a pioneer being a bird who does all the hardest work and then dies or grows old before it starts to return dividends.

With this flock of aircraft being splattered over the peaceful countryside, Karl Ort displayed rare acuement by diving underground, going in for digging copper in an Arizona mine. When Karl came up for air, planes were no longer zipping hither and thither, like cosmic rays, or something. But the purchase and resale of the parts draped on trees, telephone poles, mountain sides and pastures looked like a business opportunity, but he had only $125—nobody got rich in the army. After a short venture in umbrella and paint brush handle making, he decided the air was now clear enough to permit one to stagger cautiously into it. A cigar manufacturer in York offered him $15,000 per annum per ship for advertising cigars; so he bought three DH6 planes from Clarence Chamberlin and Basil Rowe, the old bull-fighter, who had either bought them or got them somewhere, somehow.

Hiring two other pilots—one of them was the late or lost Paul Redfern—Karl barnstormed through 28 states, dropping sample cigars in paper parachutes, and bits of the DH's as they chanced to fall off. The plan was so good and successful that the members of the firm each tried to grab the whole business out from under their partners and ended by suing each other for a half million dollars each, with the not unnatural result that the suits dragged through the courts for eight years, or until the lawyers had got all the partners' bank accounts. Doug Davis made $20,000 to $25,000 a year income over a period of three years in 1924, 1925, and 1926 working the same advertising plan for *Baby Ruth* candy. Like barnstorming, that advertising plan passed into history; to-day it would be a flop. The only things they drop out of airplanes now are parachute jumpers—and nobody bothers to pick them up, even if they have a 5-cent cigar attached to them. Karl still has one old DH6. He thinks it ought to be worth $2000, as a curiosity and the last of its line. Any offers? . . . I thought not.

Well, the cigar business went up in legal smoke and Karl dickered with a candy company to drop candy bars. But before he could close the contract to ruin the digestion of young America the sales manager was fired along with the plan. Karl then chased a breakfast food contract, and Government surplus sales, until one morning he woke up to the fact that he had no money, but he did have a load of 600 airplane engines in his lap. I said 600, not 60, or 6. It was then that he was laughingly known as the OX5 King. He had them in warehouses all over the country, pieces of them in his pockets, and they finally got in his hair. He couldn't sell those engines, or eat them, but all the time the storage and overhead was gradually eating him. So he was reluctantly forced into the aircraft supply business in 1929. He didn't want to get into it, God knows, as he had been brought up right, but he was driven to it—that's his excuse. To this day his people think he's making a respectable living as a safe-blower or some other similar profession.

# CYDELITES on the NEWS

## CY CALDWELL

● Let's have some plain speaking about these American pilots who have signed up for war service with the Loyalist or Rebel forces in Spain—there are some already fighting on both sides and more are being recruited daily in New York. Some we hear—and this so far is unconfirmed rumor—have been killed; others have received bonuses for shooting down enemy planes. The pay is $1500 a month with $1000 for every plane shot down.

Clouded though it is with the murk of national selfishness and international intrigue, with commercial advantage and the grabbing of territories, there is, after all, from the standpoint of the man who takes part in it for patriotic reasons, a certain nobility in war. Though the thinking soldier may see clearly that selfish merchants, bankers, industrialists and politicians are making huge profits from war, and that the thing basically is a sordid affair, yet he may truly feel that he is fighting for his country, for a desirable system of government, for the measure of liberty in which he believes. Motivated thus, his business of killing is not sordid, certainly is not mercenary—for his pay is small enough to tempt no one. He is fighting for a cause in which he believes—or he would not be fighting. Even though we deplore war, we must respect the motives of the man who unselfishly offers his life, as he thinks, in the defense of his country.

But what are we to say of the man who can be hired for a price, to kill others, themselves fighting in a war in which he, as an American, should have no part? Giving him the benefit of every doubt—and I for one do not accord him that benefit—he is an adventurer, fighting less for hire than for thrill. But if any there be who claim to be mere adventure seekers, or any who claim that they are fighting for a "cause" in which they believe, I would then remind them that Spain is a poor country, that both sides to the struggle are desperately poor and are fighting with borrowed foreign money. Therefore if that American is fighting for the "cause" he will accept only his support as a soldier, and refuse to accept the $1500 a month and the $1000 for every plane he shoots down. Of course there are none such; all will take what they can get—*if* they get it. And in this connection it is reasonably certain to assume that those on the losing side, whichever side that may be, will receive nothing—for the winning side will take everything, as is their right, including money deposited in foreign banks.

These American pilots on both sides of the Spanish civil war are simply and plainly hired assassins, and hired precisely as gangsters are hired to commit murder. They are not soldiers fighting for their country, for Spain is not their country. As to the political views involved, it is a case of Fascist on one side, Communist on the other—and both systems are enemies of the American democratic form of government. All that remains for an American to fight for, then, is the money; precisely as all the gangster is shooting another for is money.

As an American I resent these hired bravos of ours committing murder among the Spaniards—who may kill each other to their heart's content so far as I am concerned. That is their fight, and I don't presume to dictate how they should fight, and for how long, or with what—it's none of my business. But it is the nation's business if unprincipled Americans hire themselves out as mercenaries, and sail off to slaughter people in foreign lands—including, without a doubt, women and children and other non-combatants below. These fellows are potential murderers when they start, and actual murderers if they are successful in their fights They are base and shoddy fellows; and if a dozen of them on one side slaughter a dozen of their fellow-Americans on the other, the United States will be the gainer.

---

● One of my six disgruntled readers—the one who is always belittlin'—writes in peevishly about the drawing in a recent advertisement in which a young lady is seen waiting for her ship to come in. If the windcone in the drawing is telling the truth, her ship is coming in cross-wind, and my correspondent wants to know if the advertiser wishes us to infer that his ships are so easy to fly that they can land in any direction, or that ladies' ships usually come in cross-wind.

Now, the fact of the matter is that this ship is equipped with the Giesse wind-sock straightener, a device invented by John H. Giesse of the Bureau of Air Consternation to help get him about the country in his frantic search for aeronautical ideas, if any. Mr. Giesse, an antic fellow at heart, who likes to land downwind just to be different and call attention to himself, was frequently annoyed to observe the wind-sock blowing directly away from him as he came in to land in his favorite direction. Infuriated at this recalcitrance, or something, of an inanimate object, Mr. Giesse set himself to outwit the sock, with the result that the Giesse wind-sock manipulator is thrown on the market willy-nilly. With this clever device the pilot merely approaches the sock with a malevolent expression on his face, turns on the straightener, and in a moment the sock is blown into the desired direction by a blast of hot air, supplied by Fred Neely of the Bureau's press department. Now the only thing Mr. Giesse has to perfect is his further invention of a blower to reverse the direction of all the wind on the airport.



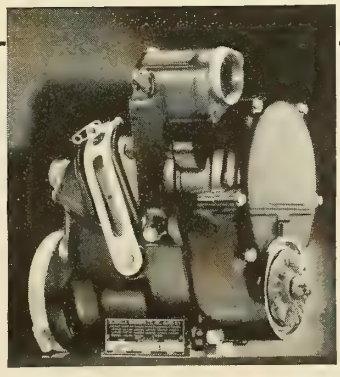
*Since 1927*

PENNSYLVANIA-CENTRAL AIRLINES

*and their predecessor companies have used*

**SCINTILLA** AIRCRAFT MAGNETOS

As standard ignition equipment on all Pennsylvania-Central planes today, SCINTILLA is helping this outstanding company to provide better service than ever before offered between Washington, Pittsburgh, Akron, Cleveland, Detroit, Lansing, Grand Rapids, Muskegon and Milwaukee.



*Every month:*

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- 45,000 pounds of air mail

SCINTILLA MAGNETO CO., INC.
*(Subsidiary of Bendix Aviation Corporation)*
Sidney, New York

# Digest of Technical Articles from Foreign Publications

(Continued from page 36)

### Experimental Research

*Variable Density Tunnel of the Gottingen Aerodynamical Research Laboratory (Der Uberdruck-Windkanal der Aerodynamischen Versuchsanstalt Gottingen, H. Winter). The German Research Laboratory for Aircraft (DVL) in the year* 1935/36. *(Die Deutche Versuchsanstalt fur Luftfahrt in Jahre* 1935/36, *Joachim Bramer). Modern Installations and Testing Equipment for Power Plant Research (Neuzeitliche Einrichtungen und Hilfsmittel der Triebwerkforschung, Oskar Kurtz). Luftwissen, Bd* 3, *N* 29, *Berlin, September,* 1936

It can be seen that the greatest part of the September issue of Luftwissen is devoted to the description of the new research equipment at Gottingen and DVL. It is significant and worthy of our interest that the amount of means placed at the call of the German industry in proportion to country's resources make our research laboratories appear small. The Gottingen variable density tunnel has a range of operating pressure from 0.3 to 3 atmospheres and the maximum jet section of about 22 by 15 feet.

DVL facilities include the following laboratories: Aerodynamics, Structures, Flight, Hydrodynamics, Materials, Power Plants, Thermodynamics, Fuels, Meteorology and Navigation, Electrophysics, Aerial Mapping, et cetera.

### Design

*XV Paris Salon* 1936. *(15 Pariser Salon* 1936, *Oscar Ursinus, Flug Sport, N*$_2$. 24, 25 *November,* 1936)

Description of the types of aircraft exhibited at the 15 Paris Salon is given. The following types are covered briefly: *France,* Amiot 341, Bloch, Breguet 462 "Vulture," Breguet flying boat 730, Dewoitine D.338, Dewoitine D.513, Dewoitine D.317, Farman transport 224, Fauvel A.V. 10, Gourdon seaplane 832, Hanriot 220, Lioré et Olivier H. 45, Lioré et Olivier H. 46, Loire pursuit 250 Morane-Saulnier single-seat fighter 405, Morane-Saulnier 430, Mureaux single-seat fighter 190C1, Mureaux 200A3, Romano R80.

Light planes mentioned are: Peuret, Farman, Mauboussin, Mignet, Kellner-Bechereaux E-1, Volland biplane V10, Trébucien X1, Brochet, Leopoldoff and Bosson. *Holland:* Fokker fighter G1, Koolhoven single-seat fighter FK. 55. *Czechoslovakia:* Benes and Miaz BE 550, Letov S528, Praga 210. *Poland:* Single-seat fighter PZL P.24. *USSR:* Long range airplane ANT 25, ANT35, single-seat fighter ZKB 19, Stal 2, flying boat ARK3, glider "Stachanovez."

A few drawings and photographs accompany the article.

### Silencers

*The Variation of Exhaust Gas Temperature Along the Tail Pipe of Moth Aircraft, and the Effect of a Simple Silencer. A. W. Morley M.Sc., communicated by the Director of Scientific Research, Air Ministry (Great Britain). Aeronautical Research Committee Reports and Memoranda No.* 1705, *August,* 1935

An investigation is presented of the variation of the exhaust gas temperature in a long tail pipe with and without a silencer based on experiments made on a Moth.

The installation consisted of: (a) a standard tail pipe about 11 ft. long leading along the port side of the fuselage with an expansion chamber about 6 ft. from the open end of the tail pipe; (b) A plain pipe of the same length and diameter, but with no expansion chamber; and (c) A Burgess silencer fitted in place of the expansion chamber in (a) above.

Gas temperatures were measured with thermocouples, arranged at six points approximately 2 ft. apart along the tail pipe, one thermocouple being arranged to measure gas temperature near the center of the silencer. Tests covered conditions of level flight, full throttle climb, and glide.

The maximum exhaust temperature with any of the exhaust systems which were full throttle conditions of level flight or climb was found to be at 1⅓ ft. from the engine decreasing 27° C./ft. run along a plain tail pipe.

### Cooling

*The Cowling of Cooling Systems. R. S. Capon, O.B.E., B.A., F.R.Ae.S., communicated by the Director of Scientific Research, Air Ministry (Great Britain). Aeronautical Research Committee Reports and Memoranda No.* 1702, *March,* 1936

The report analyzes cowled radiator with special reference to the type in which the flow of cooling air is controlled by altering the cowl rear exit area. In a preliminary examination the variation of air density is neglected; the modifications required when variation of density is included are then discussed. In the appendix the performances of a cowled radiator are compared when the flow of cooling air is controlled (a) at the rear exit; (b) by shutters at the entrance; (c) by retracting the radiator; and (d) when it is not controlled. In another appendix a method of analyzing the results of wind tunnel experiments on cowled radiators is suggested. The report deals primarily with radiators for liquid coolants, but reference is made to the cowled air-cooled engine.

### Flight Tests

*Full Scale Experiments at High Incidences with a IIIF Seaplane. Woodward Nutt, B.A., communicated by the Director of Scientific Research, Air Ministry (Great Britain). Aeronautical Research Committee Reports and Memoranda No.* 1703. *February,* 1934

No measurements of lift, drag and elevator angles required to trim have hitherto been made for full scale seaplanes at angles of incidence much above the stall, and even for landplanes the data of the subject are scanty. Wind tunnel experiments made at the N. P. L. with a 1/15 scale model of a IIIF seaplane (without wing tip autoslots), in connection with the research on the spinning of seaplanes, showed that a trimming incidence of 49° was reached with the elevators fully up, as compared with a value of 23° for the same model without floats. The exceptionally high trimming incidences indicated by the model can be reached on the full scale IIIF seaplane. A number of glides are reported at incidences over 35° and two at incidences of about 50°. In glides at these high incidences the control column of the IIIF is pressed firmly back, and the aircraft is so unstable both laterally and longitudinally as to be barely controllable.

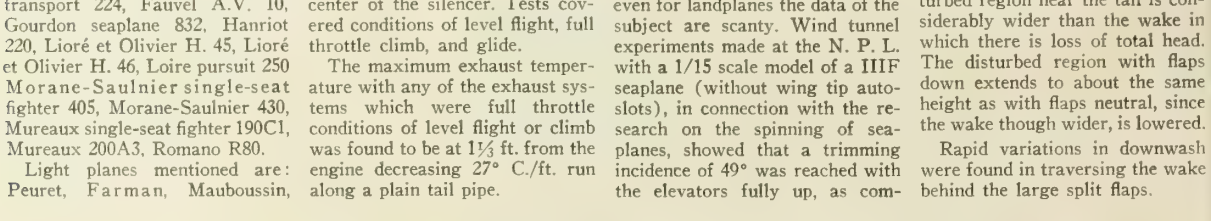
### Aerodynamics

*Wind Tunnel Tests of the Characteristics of Wing Flaps and their Wakes. K. W. Clark, B.Sc., D.I.C. and F. W. Kirkby; communicated by the Director of Scientific Research, Air Ministry (Great Britain). Aeronautical Research Committee Reports and Memoranda No.* 1698, *August,* 1935

Types of flaps tested on the RAF44 airfoil section included plain; plain with leading edge wing slot; Handley Page slotted; split, attached to lower surface of the slotted flap; split-Schrenk type; split-Zap type.

The author concludes that if a flap of 10% of the wing chord is used there is little to choose between the plain and split flaps as regards lift and profile drag. But, as flap size increases the Zap flap gives the higher lift coefficient and the Schrenk and Zap flaps have larger profile drags then the other types. The Handley Page slotted flap has a low drag which will be useful for take-off, and two methods of increasing the drag for landing were tested (1) pulling the flap down beyond the optimum angle for lift, and (2) splitting the rear end of the flap, which increases the maximum lift, but involves a second control. It was also concluded that the pitching moment of a Zap flap is larger than that of a corresponding Schrenk type, and that the disturbed region near the tail is considerably wider than the wake in which there is loss of total head. The disturbed region with flaps down extends to about the same height as with flaps neutral, since the wake though wider, is lowered.

Rapid variations in downwash were found in traversing the wake behind the large split flaps.



*Longitudinal section of propeller performance testing unit of D.V.L., central research and experimental laboratories (Germany)*

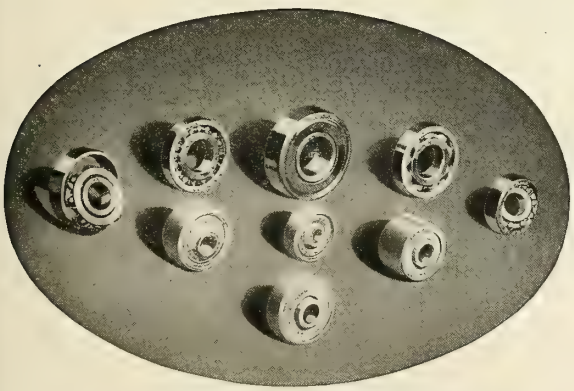
# The BOEING "FLYING FORTRESS"



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# PRECISION BEARINGS



The NORMA-HOFFMANN PRECISION LINE of ball, roller and thrust bearings comprises 108 distinct series embracing over 3000 catalogued sizes including the aircraft control bearings pictured above—a PRECISION BEARING for every load, speed and duty. Write for the Catalog. Let our engineers work with you.

This giant 4-engined bomber — America's largest landplane and the fastest bombardment plane in the world—is one of thirteen now being built for the U. S. Army Air Corps by the Boeing Aircraft Company of Seattle, Wash.—another of the many builders of aircraft and aircraft equipment who employ NORMA-HOFFMANN PRECISION BEARINGS. They are here used in the Boeing plane proper—in the Sperry Gyropilot—in the Pioneer Turn-and-Bank Indicator—and in the Pioneer Autosyn Tachometer.

Where the bearings must not fail—on land, at sea, or in the air—NORMA-HOFFMANN PRECISION BEARINGS are the choice of engineers and designers of planes, engines (including superchargers), engine accessories, control apparatus, instruments, radio equipment, cameras, and landing field equipment.

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PRECISION BALL, ROLLER, AND THRUST BEARINGS

## Newest Developments in the Field of Aircraft Radio

### New Simon Radioguide

The Simon Radioguide model D embodies the ratio principle of its predecessor, model C (AERO DIGEST, May, 1935), but the loops are no longer separate, being in a unitary structure mounted directly atop the receiver. The loops are at right angles to each other, giving better definition of off-course bearings.

In addition, the loop unit is rotable, permitting operation of the Radioguide as a goniometer. Greater accuracy of off-course bearings is thus made possible, as night error is not introduced when the transmitting station lies on a line bisecting the angle between the loops.

The apparatus is intended primarily for use in tandem-seat airplanes, to be mounted between the pilot and the observer, with the loops housed within the cockpit cowling, outside the metal structure of the ship. Height of the loop unit above the receiver may be increased to meet installation requirements.

The number of controls is less than former models without detracting from the versatility of the instrument. The indicating meter, mounted directly on the receiver, is housed in a standard 3.75 in. aircraft instrument case, and provision is made for mounting an auxiliary meter in a remote position.

The Radioguide is a twin-channel receiver, each channel fed by one of the twin loops. A loop is most responsive to signals lying within its plane, and least responsive to those at right angles to it; between these two points responsiveness varies as the cosine of the angle between the source of signal and the plane of the loop. Thus, the ratio of signals induced in the two loops remains constant for any given bearing, permitting measurement of the direction of the transmitting station in degrees of arc with respect to the longitudinal axis of the airplane. The indication is obtained by two crossed pointers, each deflected in proportion to the signal induced in its corresponding loop. Reading is taken by the intersection of the pointers, directly in degrees, from the instrument scale. Means are provided for balancing the gain in the two channels to ensure pointer deflection in true proportion to the incoming signal.



*The new compact Model D Simon Radioguide*

It is understood that the manufacturer will soon announce a remote control instrument, Model E, intended for airline operation.

### Lear Motoreel

The new motor-driven antenna reel and indicator, manufactured by Lear Developments, Inc., is a useful addition to aircraft radio.

The rated power of a transmitter means little: it is the amount of power radiated by the antenna that matters. Accurate matching of antenna load to the output impedance of the transmitter is absolutely necessary; not infrequently a 50-watt aircraft transmitter may deliver only 5 watts to its antenna due to mismatch.

Despite its mechanical disadvantages, the familiar reel type weighted trailing wire antenna remains the best electrical solution of the transmitting antenna problem. With proper fairleading, its radiation losses are negligible; and by varying the length of the wire it is possible to secure maximum antenna output under all operating conditions. This feature is especially noteworthy because modern aircraft radio operation necessitates transmission on more than one frequency. With the limitations imposed by the airplane's structure, it is difficult, and sometimes impossible, to secure uniformly good results on different frequencies when a single fixed transmitting antenna is employed.

With the Motoreel it is possible to pre-select any given length of antenna, turn the switch to the "out" position, and the Motoreel will automatically reel out the length of antenna selected and stop. Warning lights on the control unit remain on while the antenna is extended, and go out only when the antenna is completely retracted. Use of an antenna current meter in conjunction with the control unit enables the pilot to select the correct antenna length for each frequency, and mark them on the indicator for future reference.

The swivel fish at the end of the antenna is so arranged that with the antenna completely retracted, a short flexible piece of wire still extends for short-range communication when approaching airports for landing, and for communication with the control towers while the ship is on the ground.

Weight is less than 10 lbs.




*Lear Motoreel units compared in size with a telephone*

### Guarding Antennas

Satisfactory insulation of antennas is now receiving considerable attention, for under icing conditions, it is not infrequent that a flash-over occurs at the high-power end of transmitting antenna, causing destruction of the transmitting equipment aboard the airplane. A simple solution of this problem was made by United Air Lines and applied to all their ships, and similar provisions are now being made on other airlines.

A streamlined varnish-baked bakelite stub mast is attached to the vertical fin of the tail structure, projecting to a height of about 6 in. This height clear of the airplane structure has been found adequate under operating conditions. In operation, it was found that only a narrow strip of ice will build up along the leading edge of the mast.

Icing-over of the receiving antenna insulators (as distinguished from ice static) results merely in a drop in the output of the receiving equipment, which, under

(*Continued on following page*)




CHANCE VOUGHT AIRCRAFT
East Hartford, Connecticut
*Division of*
UNITED AIRCRAFT CORPORATION

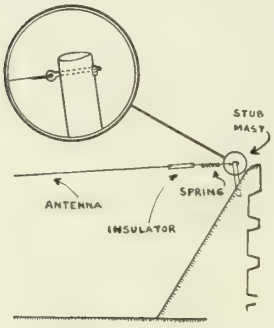
Eighty-four of these SBU-1 Scout-Bombers have gone into service with the U. S. Fleet during the past few months. Outstanding in performance and tactical effectiveness, they are already adding new lustre to this famous name—

# *Vought Corsair*

*** An additional production order for airplanes of the same basic type has just been placed by the U. S. Navy.**

(*Continued from preceding page*)
extreme conditions, may amount to as much as 25%. With clean ice, losses are negligible, but in the presence of ice containing a large number of conductive particles, such as soot, the problem becomes more serious.

***Diagram of United Air Lines' streamlined bakelite stub mast showing its attachment on the fin***




## RCA Crystal Attachment

Model AVA-8 Crystal Attachment has been especially designed by RCA Manufacturing Co., Inc., to provide crystal control of receiver frequency. Because of the general use of crystal controlled transmitters on aircraft, the same means of receiver frequency control proves most satisfactory and is necessary for satisfactory operation in airline or airport traffic control work.

The new attachment utilizes latest RCA electrical design features and is easy to attach to the receiver, as well as simple to operate. It is designed particularly for application to the AVR-5A and AVR-11 airport receivers, but may be adapted to any of the RCA all-wave instruments.

Designed as a cabinet model it may be placed on top of the AVR-5A or AVR-11 receiver. Interconnections are made at the rear of the chassis and controls are in front of the operator for maximum ease of operation. It also comes in two rack panel mountings.

Model AVA-8 attachment provides for crystal control of any two frequencies in the aviation communications band of 2000 kcs. to 6500 kcs. The crystals used are of the Vee cut low temperature coefficient type, mounted in AVA-10 crystal holders.

When operating with this unit, the receiver may be pre-tuned to one frequency, thus allowing for three-frequency operation with two frequencies being crystal controlled. Or, the receiver may be used as a conventional receiver. Two controls on the front panel serve for complete control of the unit; one being a filament on-off switch, the other a four-position switch controlling remote operation; day frequency; night frequency and conventional receiver.

Model AVA-8 consists of a duo-radio frequency amplifier; duo first detector with crystal oscillator combined; and a common intermediate-frequency amplifier. Any pair of frequencies within the frequency range of 2000 kcs. to 6500 kcs. may be used by obtaining the proper crystals and making the necessary tuning adjustments. The unit receives its plate voltage supply from the receiver chassis but the tube heaters are energized by a built-in transformer. The additional 110-volt a-c power required is 12 watts. Special interconnecting cables are supplied for wiring this unit to the receiver.

In use, the attachment replaces the radio frequency and first detector and oscillator, and adds another stage of intermediate frequency amplification to the receiver. The receiver is operated conventionally when the crystal attachment switch is turned to "Receiver." The unit is shielded for reduction of extraneous noise and for permanence of adjustment.

## INFLUENCE OF AIR POWER

(*Continued from page 20*)

could not be starved as quickly as could the people of England on their thickly-populated island.

As to England's present interceptor fighters armed only with machine guns or one small cannon—how effective are they? The enemy may attack the Port of London in full force; London may send up its interceptor force—and the defensive forces scattered about other important centers will wait idly on the ground or spend their energies frantically flying toward London, arriving after the bombers have departed. Or, expecting attack, all may concentrate at London—while the enemy attacks Liverpool or Bristol or Southampton. Where will the enemy hit? When? In what force? Only the enemy knows.

As a defense against air power, the British Navy may be dismissed in a paragraph. Save for its air component, it will be absolutely ineffective. Besides, few of the fleet airplanes are of a type suitable for combat with modern bombers. The fleet itself cannot survive unless it moves out into the open sea, hundreds of miles away from England.

This was amply demonstrated during the Italian conquest of Ethiopia, rendered possible solely by Italian air power—a fact that is not generally understood even by air officers. The actual use of bombardment planes against the Ethiopians was a mere matter of tactical employment of the air arm, effective in shortening the duration of the conflict, but of little consequence in the broader field of national strategy. The winning of the war actually was made possible by the *mere threat* of air power *which was never used.* For without the threat of the Italian Air Force *in Italy* against the British fleet in the Mediterranean, England would have closed the Suez Canal to Italy, and the Italian expeditionary force would have been left stranded in Abyssinia—cut off from its supplies of food, ammunition, and gasoline for its transport and its airplanes. The war would have stopped for lack of gasoline (or "petrol") and oil!

England, you recall, tried to use the France-and-England-dominated League of Nations to enforce sanctions against Italy. Seeing the British lion peeping out under the sheep's hide that the League so closely resembles, Italy immediately denounced England, who in answer unthinkingly concentrated her navy at Malta, the great naval base which is only about 60 miles from Italian aerodromes. The Italians then moved the greater part of their air force within easy striking distance of the British fleet. Alarmed, and with reason, the British fleet immediately got up steam and fled to Alexandria, Egypt—the first time in the history of the British Navy that it has run away without a shot being fired at it, and at the mere threat of air bombardment by a second class naval power—but a first class air power—with which it was not at war. This damage to England's prestige has not gone unnoticed by European powers, who are straining every energy to build up tremendous air forces.

Now think back for a moment and considering one by one the points marshalled—England's tiny area, her large population, her method of feeding her people, of trading with the world, the lack of defense against air attack, the lessons to be drawn from the submarine campaign and the Italian defiance of England's now impotent navy—let the relationship of those apparently unrelated topics grow clear. Does it not become plain that in the next continental war in which she is involved, England should not have within the confines of her small island *more people than the land itself can feed?* For she will be unable to bring food to them in ships. But the people are there—waiting as helplessly as fledgelings in a nest, and all with appetites. They have not begun to realize that air power will force the migration of peoples, will cause a redistribution of population on the face of the earth; and that the English must be the first to move—or perish as a nation while their far-flung Empire falls apart.

With air power dominant, an island-controlled empire today is an impossible political entity. Air power is a disruptive, a changing force, the impact of which upon the political and economic life of nations cannot be warded off or dodged.

The greatness of the British Empire was founded upon her sea power. Today sea power is supplanted by air power—even this embryonic air power of our times. The world is changing, as it ever will be changing. But it is changing now more rapidly than ever before.

We peer ahead, seeing dimly, for the rush of technical progress blurs our vision. Yet we may glimpse, though vaguely, that air power must rule and change the world as we know it now. The air arm is the arm of space; it need not proceed along roads, need not seek the valleys, need not skirt the mountains. Within its own technical limits it can go anywhere, at any time, at any height, passing over all land and sea forces, to encounter and give battle only to what opposing air force may be marshalled against it, and that briefly. It brings death swiftly, and as swiftly departs—the most deadly yet the most illusive fighting force ever devised by the self-destroying ingenuity of man.

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WILLIAM DAVIS, NEW YORK
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HOWARD FRASER, NEW YORK
EDWARD GIBBS, NEW JERSEY
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STANLEY GORCZYCA, PENNSYLVANIA
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WILLIAM McREYNOLDS, MISSOURI
DONALD NAIL, ARKANSAS
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JAMES RINEHART, OHIO
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CHARLES SPAULDING, MASSACHUSETTS
WILLIAM SCAMMON, MISSOURI
WILLIAM SHEPARD, KANSAS
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# EQUIPMENT and METHODS

## Notes on Machinery for Aircraft and Engine Production

### Pantograph Cutting Torch

Production of the four-engined bombers for the U. S. Army Air Corps and now the Boeing Clippers for Pan American Airways calls for the manufacture of steel parts of unusually large sizes—a process which has involved increasing use of a recently installed pantograph cutting torch.

By means of the burning operation, steel bar or sheet is readily shaped to within a fraction of an inch of the required finished dimension, at a saving of hours of machining time, especially in the case of parts of irregular shape that would otherwise require a large amount of preliminary planing.

In operation the machine automatically follows the curves of special templates laid out on a flat table, thus accurately steering an arm that moves the vertical jet of an acetylene torch over the steel stock being cut. The templates, constructed by workmen in the company's welding shop, where the machine is installed, consist of ¼" × 7/16" strips of aluminum mounted on flat plates with hollow rivets. Fine teeth in the machine's guide-wheels bite into these strips as they move along at a speed which can be varied from 5" per minute to approximately 5' per minute. Speed is controlled by an *Oxweld* variable speed electric motor equipped with a worm-gear reduction drive.

An examination of the process employed in the manufacturing of landing gear strut terminals for the new YB-17 bombers furnishes a typical example of savings effected by the use of this machine. These fittings were rough burned from 9.25" × 12" billets of SAE 4130 steel, to within ¼" of finished dimensions. After burning, each part weighed approximately 180 lbs. If hacksawing had been employed instead of the burning method, the rough parts would have weighed 314 lbs.—in other words, 134 additional pounds of metal would have to be removed by machining. The saving of metal is apparent, since this 134 lbs., if removed in a planer, would be scrap in the form of planer chips, while in the case of the burning method the parts are nested, leaving only a thin wall of metal between them.

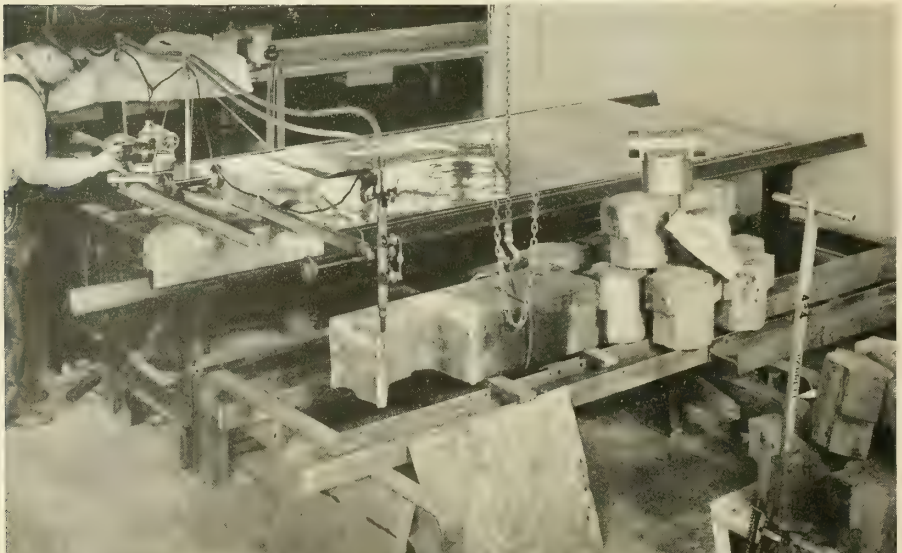
Perhaps even more significant is the saving in time. The burning operation on one of these parts took 75 min., or 2.5 man-hours since two men are required to operate the machine—one at the template end and the other at the torch end. On the other hand, at least 24 hours of machining time would have been required if the parts had not been burned to shape. Upon completion of the burning operation the parts were finish machined and heat treated, the finished weight of each being 41 lbs., including bushings.

In addition to its use in the making of landing gear parts, the burning machine has been used in the forming of all engine mount fittings and all flat-plate wing terminals for the YB-17 bombers.

The machine handles sheet and bar stock as large as 54" wide × 12' long, and from 3/8" to 24" in thickness. Parts less than 1" thickness can be burned to 1/64" of finished dimension. Twelve-inch stock can be burned to 1/8" of finished dimension, although normally such heavy stock is burned only to within ¼". SAE 4130 steel up to 12" in depth is burned cold, while stock as thick as 24" is preheated to 1000° before the burning. SAE 4345 steel is normally preheated to 1000° for burning at 10" or 12" depths.

While the principal advantage of the cutting torch is found in the burning of large steel parts of irregular shape, the machine has also proved an excellent substitute for the hacksaw in such simple operations as cutting bar stock into sections. A bar measuring 9" × 10" required 75 min. to be sawed in a power hacksaw, whereas the operation was performed by the burning machine in 3 minutes.

*Boeing's pantograph burning machine working on landing gear parts*

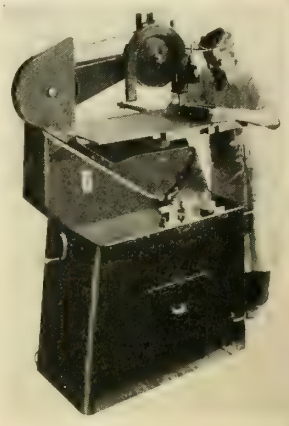


### Filing-Sawing Machine

A machine capable of providing extra-deep throat precision sawing operations has been developed by Continental Machine Specialties, Inc.

Known as Model JXD, this unit incorporates the features of *Doall* combination sawing and filing operations on internal or external work. Table area is 22" by 30.5", and the throat 25", with heat treated nickel iron being used for the table and machine frame.

The third idler wheel is tiltable the same as the main upper wheel,



to permit easy and exact tracking of the blade. For the band filing function, an extension section is coupled into the standard *Doall* file band, to get the extra length. This model is so made that it can be used without employing the third idler wheel for jobs that do not require the deep throat capacity.

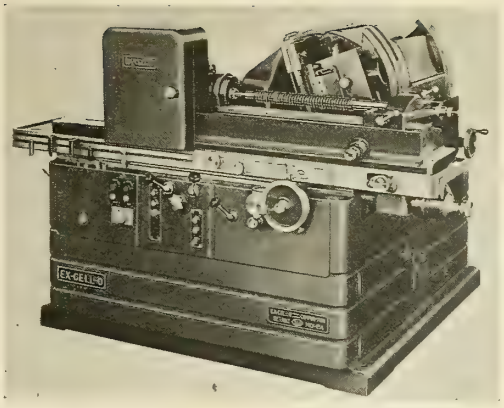
### Universal Precision Thread Grinder

Ex-Cell-O Aircraft & Tool Corp. are marketing a universal precision thread grinder with a capacity for grinding external threads 8" in diameter, 24" long, on a maximum length work piece of 33" between centers. The machine is also adapted for grinding internal threads on work having threads not smaller than 1" in diameter, 1" long, up to 8" diameter, 3" long. U. S. Standard form, sharp "V," 29° Acme, up to and including 60° thread form and modified Buttress threads with

single, double, triple, quadruple or sextuple threads within the range of pitches from one to 40 can be ground on this machine. Tapers up to 2" per foot included angle can also be ground. A lead tolerance of .0002" per inch when grinding U. S. Standard form threads can be maintained.

The machine is automatic in its grinding operations except for loading and unloading the work and withdrawing the grinding wheel at the end of the cut. It will grind to a predetermined size setting and then automatically stop feeding; or it may be set so that the table will stop at either end or at any point of its travel.

A variable high speed control is used to adjust the approach speed of the work to the grinding wheel in either direction of spindle rotation or table travel. Individual spindle speed adjustments are provided for each direction of table travel or spindle rotation, and are used as work speed adjustments for controlling the speed of the work while grinding. A lead compensating device corrects the lead error caused by taper setting. A hydraulically controlled backlash device for compensating the lead screw and gear backlash is also provided. A back-off attachment can be furnished with the machine with capacity up to 18" length work. The hydraulically operated wheel dresser is operated from the front of the machine.




*The Ex-Cell-O universal precision thread grinder with high-speed control*

The grinding wheel spindle is precision ball bearing equipped. A 3 hp totally enclosed ball bearing driving motor and wheel spindle are mounted in a cradle that can be adjusted so that the grinding wheel will grind up to 30° to suit the helix angle of right-hand threads and up to 45° for left-hand threads.

On a separate rubber cushioned base, located at the rear of the machine, are mounted the hydraulic pump, oil filter and electrical drive motor. Coolant is furnished by a vertical centrifugal pump with direct connected electrical motor, mounted on the removable coolant tank located in the base and at the rear of the machine.

## Hoffman Bearings

Precision bearings in two types —the "9000-D" Series, with single side shield, and the "9000-DD" Series, with two side shields have been developed by Norma-Hoffmann Bearings Corp.

These bearings employ inwardly extending, closely-fitted flanged shields which do not rotate or contact with rotating seal parts, are equally effective in retaining grease in a horizontal or vertical position and, not being subject to wear, permanently maintain their efficiency.

The metal seals clear the recess on the inner ring, obviating the possibility of drag or frictional resistance. Consequently, there is no power low—which means higher speeds and increased efficiency in certain types of units. The shields occupy less space within the bearing than the standard felt seal, and the "9000" Series has greater grease capacity and a more lasting lubricant supply for long continuous service.

In the "9000-DD" type, bearings are totally sealed against dirt or foreign matter during assembly, operation or disassembly, providing absolute cleanliness at all times. This series is available in a full range of sixes and interchangeable with single felt seal bearings of the wide outer ring type from 6 mm to 26 mm in bore.


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America's leading commercial airlines —as well as Army and Navy and many private fliers—use Packard ignition cable on their ships. They *have* to be sure. For aircraft engines operate under unusually severe conditions—necessitating spark plug wires with exceptional resistance to heat, oil, moisture, abrasion, cold, age and corona. Packard FOUR-FORTY ignition cable resists these "enemies" better and longer than ordinary rubber or lacquered cables do, because of its specially-tough, secret-formula inorganic-base sheath. Take a tip from the leaders—insist on Packard FOUR-FORTY when making ignition cable replacements! Packard Electric Division, General Motors Corporation, Warren, Ohio.

Packard
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# INDEX TO THE MANUFACTURERS OF AIRCRAFT & ENGINE MACHINERY

***The following pages contain a directory of the sources of supply of machines and special equipment used in the manufacture of aircraft and aircraft engines. The listings are as complete as can be made with the information available. The accompanying Index indicates the manufacturers listed. Complete data relating to the companies is given in the Directory Section (pages 68 to 83) where manufacturers are listed alphabetically. Companies marked (A) are also listed in the April "Digest of Aircraft and Aircraft Engines"; those marked (Ju) are also listed in the June "Digest of Aircraft and Engine Materials"; and those marked (Oct.) are also listed in the October "Digest of Airport and Airline Equipment."***

## PORTABLE UNITS
**(Metal Working)**

**ADAPTER UNITS**
Kingsbury Machine Tool Corp.

**ANGLE BENDERS & ATTACHMENTS**
Champion Blower and Forge Co.
Independent Pneumatic Tool Co.

**BORES & REAMERS**
Automatic Machine Company
Barber-Colman Company
Blanchard Machine Company
Cleveland Twist Drill Co.
Davis Boring Tool Company
Detroit Boring Bar Company
Eclipse Counterbore Company
Gairing Tool Company
Haynes Stellite Company
Kelly Reamer Company
Madison Manufacturing Company
Moline Tool Company
Morse Twist Drill & Machine Co.
National Twist Drill Company
Standard Tool & Mfg. Company
Van Norman Machine Tool Co.
Wetmore Reamer Company

**BRAKE BENDERS**
Dries & Krump

**BROACHES**
American Broach & Machine Co.
Colonial Broach Company
Ex-Cell-O Aircraft & Tool Corp.
LaSalle Machine Works
National Broach & Machine Co.

**CHUCKS & COLLETS**
Bicknell-Thomas Company
Consolidated Machine Tool Corp.
Cushman Chuck Company
Henry Disston & Sons, Inc.
Ex-Cell-O Aircraft & Tool Corp.
Errington Mech. Laboratory
Foster Machine Company
Gardner Machine Company
Logansport Machine Company
Modern Tool Works
Monarch Machine Tool Co.
National Tool Company
New Britain-Gridley Machine Co.
Rivett Lathe & Grinder, Inc.
Skinner Chuck Company
Thurston Company

**CROWNER**
Northill Company, Inc.

**CUTTING TOOLS**
Barber-Colman Company
Bicknell-Thomas Company
Carboloy Company
Cleveland Universal Jig Co.
Consolidated Machine Tool Corp.
Davis Boring Tool Company
Detroit Boring Bar Company
Eclipse Counterbore Company
Ex-Cell-O Aircraft & Tool Co.
Fellows Gear Shaper Co.
Gairing Tool Company
Genesee Manufacturing Co.
Geometric Tool Corporation
Goodard & Goodard Co.
Haynes Stellite Company
Kutmore Tool Company
National Twist Drill Co.
Modern Tool Works
Morse Twist Drill & Mach. Co.
Mummert-Dixon Company
Niles-Bement-Pond Company
H. K. Porter, Incorporated
J. T. Slocomb Company
The Stanley Works
Thurston Manufacturing Co.
United States Drill Head Co.
W. W. & C. F. Tucker, Inc.
Wadell Engineering Company

**DIES & DIE HEADS**
John Bath & Company
Carboloy Company
S. W. Card Mfg. Company
Champion Blower & Forge Co.
Cleveland Twist Drill Co.
Consolidated Machine Tool Corp.
Eastern Machine Screw Corp.
Errington Mech. Laboratory
General Electric Company
Geometric Tool Company
Landis Machine Company
Modern Tool Works
Morse Twist Drill & Mach. Co.
Muchey Machine & Tool Co.
National Twist Drill Co.
Niles-Bement-Pond Co.
Oster Manufacturing Co.
U. S. Tool Company
Wrought Washer Mfg. Co.

**DRILLS**
American Twist Drill & Tool Co.
Bradford Machine Tool Co.
Buffalo Forge Company
Cleveland Pneumatic Tool Co.
Dumore Company
Hisey-Wolf Machine Company
Independent Pneumatic Tool Co.
Morse Twist Drill & Mach. Co.
National Twist Drill Co.
Niles-Bement-Pond Co.
Providence Engineering Wks. Inc.
Standard Electric Tool Co.
The Stanley Works
N. A. Strand & Company
Toledo General Mfg. Co.
Union Twist Drill Company
United States Elec. Tool Co.
Van Dorn Elec. Tool Co.

**DRILL FIXTURES**
Cleveland Universal Jig Co.
Hoefer Mfg. Company
Siewek Tool Company

**FACING HEADS**
Gairing Tool Company
Mummert-Dixon Company

**FILING MACHINES**
Biax Jarvis Manufacturing Co.
Black Diamond Saw & Machine Wks., Inc.
Covel-Hanchett Co.
N. A. Strand & Company

**FLEXIBLE SHAFTS**
Dumore Company
Niles-Bement-Pond Co.
N. A. Strand & Company
Walker-Turner Co., Inc.

**GEAR CUTTERS**
Fellows Gear Shaper Company

**GRINDERS**
Abrasive Machine Company
Biax Jarvis Manufacturing Co.
Black Diamond Saw & Mach. Wks., Inc.
Cedar Rapids Eng. Co. of Del.
Chicago Pneumatic Tool Co.
Chicago Wheel & Mfg. Co.
Cleveland Pneumatic Tool Co.
Covel-Hanchett Co.
Diamond Machine Co.
Dumore Company
Gallmeyer & Livingston Co.
Gardner Machine Company
Gisholt Machine Company
R. G. Haskins Company
Hisey-Wolf Machine Company
Independent Pneumatic Tool Co.
Mattison Machine Works
Muchey Machine & Tool Co.
Mummert-Dixon Company
Thomas Prosser & Son
Skilsaw, Incorporated
Standard Electric Tool Co.
The Stanley Works
N. A. Strand & Company
United States Elec. Tool Co.
Van Dorn Elec. Tool Co.
Van Norman Machine Tool Co.
Walker-Turner Company, Inc.

**GRINDING WHEELS**
Blanchard Machine Company
Chicago Wheel & Mfg. Co.
Gardner Machine Company

**HOBBERS**
Barber-Colman Company
Michigan Tool Company
National Twist Drill Co.

**KEYSEATERS & CUTTERS**
Davis Keyseater Company
Mitts & Merrill

**MANDRELS**
Western Tool & Mfg. Co.

**POLISHERS & BUFFERS**
Cleveland Pneumatic Tool Co.
Dumore Company
Gardner Machine Company
R. G. Haskins Company
Skilsaw, Incorporated
Standard Elec. Tool Co.
N. A. Strand Company

**PORTABLE ELECTRIC TOOLS**
Black & Decker Mfg. Co.
Dumore Company
R. G. Haskins Company
Hisey-Wolf Machine Co.
Independent Pneumatic Tool Co.
Skilsaw, Incorporated
Speedway Manufacturing Co.
Standard Electric Tool Company
N. A. Strand & Company
United States Elec. Tool Co.
Van Dorn Electric Tool Co.

**PROPELLER PROTRACTORS, ADAPTERS**
Taft Peirce Manufacturing Co.

**PUNCHES**
Buffalo Forge Co.
Niles-Bement-Pond Co.
Henry Pels & Company

**RIVETERS**
Cleveland Pneumatic Tool Co.
Hannifin Manufacturing Co.
Ingersoll-Rand Company

**ROTARY FILES**
R. G. Haskins Company

**SANDERS**
United States Elec. Tool Co.
Van Dorn Electrical Tool Co.

**SCREW PLATES**
S. W. Card Manufacturing Co.
Niles-Bement-Pond Co.

**SETTERS**
Covel-Hanchett Co.

**SHEARS**
Gallagher Mfg. Co.
Henry Pels & Company

**STUD DRIVERS, SETTERS, PULLERS**
Apex Broach Company
Black Diamond Saw & Machine Co., Inc.
Consolidated Machine Tool Corp.
R. G. Haskins Company
Independent Pneumatic Tool Co.
Modern Tool Works
N. A. Strand & Company
Titan Tool Company
Van Norman Machine Tool Co.

**SWAGING MACHINE**
Breeze Corporations, Inc.

**TAPS & TAPPING EQUIPMENT**
John Bath & Company
Biax Jarvis Manufacturing Co.
Bicknell-Thomas Company
The Burke Machine Tool Co.
S. W. Card Manufacturing Co.
Consolidated Machine Tool Corp.
Detroit Tap & Tool Company
Errington Mech. Laboratory
Geometric Tool Company
Hanson-Whitney Machine Co.
R. G. Haskins Company
Modern Tool Works
Morse Twist Drill & Mach. Co.
National Machinery Co.
National Twist Drill Co.
Niles-Bement-Pond Co.
L. S. Starrett Company
Winter Brothers

**THREAD MILLERS**
Automatic Machine Co.
Hanson-Whitney Machine Co.

**TOOLS**
Armstrong Bros. Tool Co.
Barber-Colman Company
Blackman & Nuetzel Mach. Co.

Carboloy Company
Cleveland Twist Drill Company
Henry Disston & Sons, Inc.
Eclipse Counterbore Company
Ex-Cell-O Aircraft Tool Co.
Gallmeyer & Livingston Company
Giddings & Lewis Mach. Tool Co.
Hjorth Lathe & Tool Company
McCrosky Tool Corporation
Millersburg Reamer & Tool Co.
National Twist Drill & Tool Co.
W. H. Nicholson & Company
Nielsen, Inc.
Niles-Bement-Pond Co.
Plomb Tool Company
Scintilla Magneto Co.
Sebastian Lathe Company
Standard Tool & Mfg. Co.
The Stanley Company
L. S. Starrett Company
Stevens Walden, Incorporated
N. A. Strand & Company
Taft Peirce Manufacturing Co.
Union Twist Drill Company
Western Tool & Mfg. Co.
Wetmore Reamer Company

**Carboloy**

Carboloy Company
Ex-Cell-O Aircraft & Tool Corp.
General Electric Company

**Circular Forming**

Continental Tool Works
Michigan Tool Company

**High Speed**

Continental Tool Works
Gorham Tool Company
U. S. Tool Company

**Spotfacing**

Eclipse Counterbore Company
Gairing Tool Company
Haynes Stellite Co.
Mummert-Dixon Company

**Tungsten Carbide**

Firth-Sterling Company
Gairing Tool Company
Kearney & Trecker Corporation
Thomas Prosser & Sons

**VALVE FACING MACHINES**

Cedar Rapids Eng. Co. of Del.
Van Dorn Electrical Tool Co.
Van Norman Machine Tool Co.
United States Elec. Tool Co.

**VALVE RESEATING TOOLS**

Cedar Rapids Eng. Co. of Del.

**VALVE SEAT GRINDING TOOLS**

Albertson & Company
Carboloy Company
Cedar Rapids Eng. Co. of Del.
Van Dorn Electrical Tool Co.
Van Norman Machine Tool Co.

**VALVE SEAT TOOLS**

Cedar Rapids Eng. Co. of Del.
Van Norman Machine Tool Co.

**WASHERS**

Wrought Washer Mfg. Co.

**WELDING APPARATUS**

Bastian Blessing Company
Federal Machine & Welder Co.
General Electric Company
Harnischfeger Corporation
Haynes Stellite Company
Lincoln Electric Company
Linde Air Products Co.
Alexander Milburn Company
Oster Manufacturing Co.
Smith Welding Eqpt. Corp.
Thomson-Gibb Elec. Welding Co.
Torchweld Equipment Co.
Westinghouse Elec. & Mfg. Co.
Wilson Welder & Metals Co., Inc.

## (Wood Working)

**PATTERN SHOP ACCESSORIES**

Oliver Machinery Company

**ROTARY ATTACHMENTS**

Reed-Prentice Corp.

**ROUTERS**

R. L. Carter Company
Oliver Machinery Company

**SANDERS**

Cleveland Pneumatic Tool Co.
R. G. Haskins Company
Oliver Machinery Company
Skilsaw, Incorporated

**SAWING MACHINES**

J. A. Fay & Egan Co.
Oliver Machinery Company
Reed-Prentice Corp.
Skilsaw, Incorporated

**SHAPERS**

Crescent Machine Company
New Advance Machinery Co.
Oliver Machinery Company

# STATIONARY UNITS

## (Metal Working)

**BEADING MACHINES**

Niagara Machine & Tool Works
Peck, Stow & Wilcox Company

**BORING MACHINES**

Automatic Machine Company
W. F. & John Barnes Co.
Cedar Rapids Eng. Co. of Del.
Cleveland Twist Drill Co.
Diamond Machine Company
Eclipse Counterbore Company
Ex-Cell-O Aircraft & Tool Corp.
R. Y. Ferner Company
Moline Tool Company
Niles-Bement-Pond Co.
Reed-Prentice Corporation
Universal Boring Mach. Co.

**BRAKE BENDERS**

Champion Blower & Forge Co.
Dries & Krump

**CUTTERS**

Racine Tool & Machine Co.

**DEMAGNETIZERS**

Blanchard Machine Co.

**DIE & DIE SINKING MACHINES**

Bignall & Keller Machine Works
Cincinnati Milling Machine & Cincinnati Grinders, Inc.
Cleveland Twist Drill Co.
Continental Machine Specialties
George Gorton Machine Co.
Jones & Lamson Machine Co.
Niles-Bement-Pond Co.
Oliver Instrument Co.
Reed-Prentice Corporation
Thurston Mfg. Company
Waterbury Farrel Foundry & Mach. Co.

**DRILLS**

C. G. Allen
American Tool Works Co.
M. E. Avery Company
Avey Drilling Machine Co.
W. F. & John Barnes Co.
Barnes Drill Company
Buffalo Force Company
Canedy-Otto Mfg. Company
Carlton Machine Tool Co.
Champion Blower & Forge Co.
Cincinnati Bickford Tool Co.
Cincinnati Shaper Co.
R. Y. Ferner Company
Foot-Burt Company
Fosdick Machine Tool Co.
Grand Mfg. & Mach. Co.

*(Continued on following page)*





**. . . Announcing a 13½% Reduction on Single-Motor Installations**

**Good business for us means good news for you! We are passing along the benefits of the rapidly growing sales of LUX Lightweight Airplane Fire Systems.**

***We announce a 13½% reduction in the price of LUX Systems for single-motored planes.***

**You are familiar with the fact that LUX protects 90% of all airliners—that it reduces insurance costs. A dashboard control floods the engine compartment with a cloud of LUX carbon-dioxide snow-and-gas. Fast-expanding, this fire-killing blizzard reaches every smallest crevice, *even into the heart of the carburetor.* It takes about 3 seconds to snuff out the severest engine fire.**

**Your LUX system is just as effective at top flying speeds as when the ship is on the ground. Though LUX snow is sure death to fire, it is clean, dry and harmless to engine, wiring, or pilot.**

**LUX Announces Weight Reducton, Too**

**An engineering improvement in LUX valve design has brought about a saving of over 10% in weight on certain installations. Minimum overall weight is now under 15 lbs.**

**With Lux the fear of fire is removed. Get this sure protection for your ship.**

***Fresh from the press is our handsome new brochure, "White Magic." It completely describes LUX protection for airplanes. Write for your free copy.***

**Walter Kidde & Company**
**113 WEST STREET, BLOOMFIELD, N. J.**

**LUX AIRPLANE FIRE SYSTEM** LUX

*(Continued from preceding page)*
Kingsbury Machine Tool Corp.
Langelier Mfg. Company
Leland-Gifford Company
Minister Mach. Company
Moline Tool Company
Morris Machine Tool Co.
Motch-Merryweather Mach. Co.
National Machine Tool Co.
Niles-Bement-Pond Co.
Providence Eng. Works, Inc.
Reliance Machine Sales Co.
J. T. Ryerson & Son, Inc.
Sibley Mach. & Fndry. Co.
Standard Electric Tool Co.
Toledo General Mfg. Co.
U. S. Machinery Company

**FILING MACHINES**
Biax Jarvis Manufacturing Co.
Cochrane-Bly Company
Continental Machine Specialties

**FORMERS**
Engineering & Research Corp.
Peck, Stow & Wilcox Co.
U. S. Tool Company

**GEAR CUTTERS**
Bilgram Gear & Machine Wks.
Fellows Gear Shaper Co.
Newark Gear Cutting Mach. Co.
Thurston Mfg. Company

**GEAR GENERATORS**
Fellows Gear Shaper Co.
Gleason Works
Lees-Bradner Company

**GEAR LAPPERS**
Fellows Gear Shaper Co.
National Broach & Mach. Co.

**GEAR SHAPERS**
Fellows Gear Shaper Co.

**GRINDERS**
Abrasive Machine Company
Biax Jarvis Mfg. Company
Bignall & Keller Mach. Works
Blanchard Machine Co.
J. G. Blount Company
Brown & Sharpe Mfg. Co.
Bryant Chucking Grinder Co.
Cedar Rapids Eng. Co. of Del.
Champion Blower & Forge Co.
Cincinnati Electric Tool Co.
Cincinnati Milling Machine & Cincinnati Grinders, Inc.
Diamond Machine Company
Ex-Cell-O Aircraft & Tool Corp.
Fitchburg Grinding Machine Co.
Gallmeyer & Livingston Co.
Gardner Machine Company
Grand Rapids Grinder Mach. Co.
Grand Rapids Machine Co.
Heald Machine Company
Jones & Lamson Machine Co.
Landis Tool Company
Lees-Bradner Company
Micro-Westco, Inc.
Mummert-Dixon Company
Niles-Bement-Pond Co.
Norton Company
Oliver Instrument Company
Oesteriein Machine Company
Rivett Lathe & Grinder, Inc.
Geo. Scherr Company
Skilsaw, Incorporated
Standard Electric Tool Co.
The Stanley Works
Stevens Walden, Incorporated
Sundstrand Mach. Tool Co.
Taylor & Fenn Company
U. S. Electrical Tool Co.
Valley Electric Company
Van Norman Machine Tool Co.
Walker-Turner Co., Inc.

**HOBBERS**
The Adams Co.
Brown & Sharpe Mfg. Co.
Gould & Eberhardt
Lees-Bradner Company
Michigan Tool Company
George Scherr Company
Union Twist Drill Co.

**INSPECTION MEASURING MACHINES**
Fellows Gear Shaper Co.
Jones & Lamson Machine Co.
Lees-Bradner Company
George Scherr Company

**LAPPING MACHINES**
Cincinnati Milling Machine & Cincinnati Grinders, Inc.
Moline Tool Company

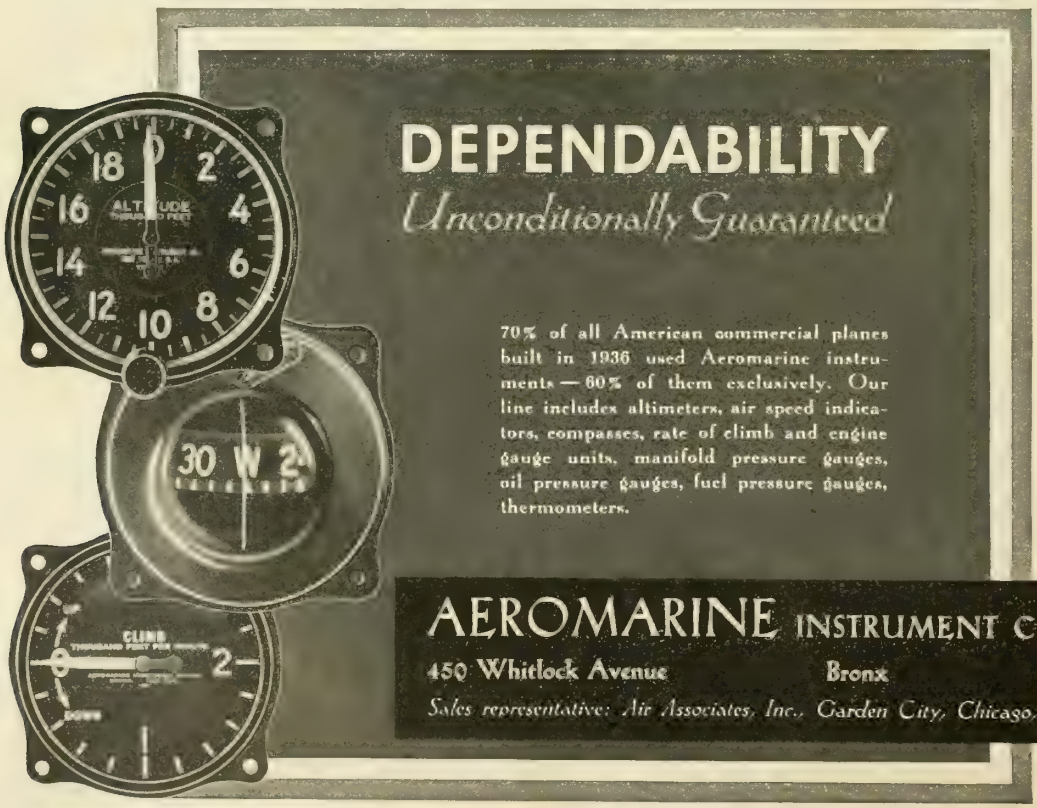
**LATHES**
American Tool Works Co.
Atlas Press Company
Automatic Machine Company
J. G. Blount Company
Brown Machinery Company
Brown & Sharpe Mfg. Co.
The Bullard Co.
Cone Automatic Machine Co.
Colcord-Wright Machinery Co.
Elliott & Stephens
Fay Automatic Machine Tool Co.
Gardner Machine Company
Kent-Owens Machine Company
R. K. LeBlond Machine Tool Co.
Monarch Machine Tool Co.
Niles-Bement-Pond Co.
George Scherr Company
Sebastian Lathe Company
Seneca Falls Mfg. Company
Seneca Falls Machine Co.
Stark Tool Company
Sundstrand Mach. Tool Co.
Walker-Turner Co., Inc.
Warner & Swasey Company
Waterbury Farrell Foundry & Mach. Co.
Wickes Bros.

**Automatic**
Cone Automatic Machine Co.
Jones & Lamson Mach. Co.
R. K. LeBlond Mach. Tool Co.
Lodge & Shipley Mach. Tool Co.
Monarch Machine Tool Co.
Potter & Johnson Machine Co.
Seneca Falls Machine Co.
Sundstrand Mach. Tool Co.
Waterbury Farrell Foundry & Mach. Co.

**Engine**
Champion Blower & Forge Co.
Fay Automatic Machine Tool Co.
Flather Co.
Greaves-Klusman Tool Co.
Hendey Machine Co.
Ideal Machinery Co.
Lehman Machine Co.
Monarch Machine Tool Co.
South Bend Lathe Works
Springfield Machine Co.

**Heavy Duty**
Bove & Emmes Mach. Tool Co.
Gisholt Machine Co.
Reed-Prentice Corp.
Warner & Swasey Company

**Manufacturing**
Bullard Company
R. K. LeBlond Machine Tool Co.
Lodge & Shipley Mach. Tool Co.
Monarch Machine Tool Co.

**Precision**
Gisholt Machine Co.
Hardinge Bros., Inc.
Hjorth Lathe & Tool Co.
Lodge & Shipley Mach. Tool Co.
Reed-Prentice Corp.
Rivett Lathe & Grinder, Inc.

**Screw Cutting**
Champion Blower & Forge Co.
Rivett Lathe & Grinder, Inc.

**Turret**
Acme Machine Tool Co.
Bardons & Oliver, Inc.
Bullard Company
Foster Machine Co.
Gisholt Machine Co.
Jones & Lamson Machine Co.
Kutmore Tool Company
Universal Boring Machine Co.
Warner & Swasey Company

**MILLING MACHINES**
B. C. Ames Company
Automatic Machine Co.
Brown & Sharpe Mfg. Co.
Burke Machine Tool Co.
Cincinnati Milling Machine and Cincinnati Grinders, Inc.
Cincinnati Shaper Co.
Cleveland Twist Drill Co.
Cochrane-Bly Co.
Consolidated Machine Tool Corp. of America
Continental Tool Works
R. Y. Ferner Co.
George Gorton Machine Co.
Gould & Eberhardt
G. A. Gray Company
Hall Planetary Co.
Hanson-Whitney Machine Co.
Hardinge Bros., Inc.
Harron, Rickard & McCone Co.
Hendey Machine Co.
Ingersoll Milling Machine Co.
Jones & Lamson Machine Co.
Kearney & Trecker Corp.
Kent-Owens Machine Co.
W. B. Knight Machine Co.
Lees-Bradner Company
Lucas Machine Tool Co.
Manning, Maxwell & Moore
Niles-Bement-Pond Co.
Oesteriein Machine Co.
Reed-Prentice Corp.
Sundstrand Machine Tool Co.
Taylor & Fenn Company
Thurston Mfg. Company
Union Twist Drill Co.
U. S. Tool Company
U. S. Standard Mfg. Co.
Van Norman Machine Tool Co.
Waterbury Farrell Foundry & Machine Co.

**MOLDERS**
J. A. Fay & Egan Co.

**NIBBLERS**
Hall & Brown Machine Co.
W. J. Savage Co., Inc.

**PLANERS**
Automatic Machine Co.
G. A. Gray Company

**POLISHERS AND BUFFERS**
Champion Blower & Forge Co.
Hisey-Wolf Machine Co.
Rowbottom Machine Co.
Standard Electric Tool Co.

**PRESSES**
Adriance Machine Works, Inc.
American Broach & Mach. Co.
Atlas Press Company
E. W. Bliss Company
Brown Machinery Co.
C. F. Elmes Engineering Works
Ferracute Machine Co.
Fox Machine Co.
Chas. E. Francis Co.
Hall & Brown Machine Co.
Henry & Wright Mfg. Co.
Hydraulic Press Mfg. Co.
LaSalle Machine Works
Geo. E. Moore
National Machinery Co.
Niagara Mach. & Tool Works
Peck, Stow & Wilcox Co.
Perkins Machine Co.
Quickwork Company
F. J. Swaine Company
Taylor & Fenn Company
Titan Tool Company
Toledo Machine & Tool Co.
V & O Press Company
Waterbury Farrel Foundry & Machine Co.
Watson-Stillman Co.
Weaver Mfg. Company
Wellman, Saver & Morgan Co.

**Arbor**
Atlas Press Company
Canedy-Otto Mfg. Co.
Champion Blower & Forge Co.
Greenerd Arbor Presses
Stedfast & Roulston, Inc.

**Drill**
C. G. Allen
American Tool Works Co.
Atlas Press Company
M. E. Avery Company
Barnes Drill Company
W. F. & John Barnes Co.
Bausch Machine & Tool Co.
Burke Machine Tool Co.
Canedy-Otto Mfg. Co.
Delta Manufacturing Co.
Excelsior Tool & Machine Co.
Foot-Burt Company
Henry & Wright Mfg. Co.
J. E. Snyder & Son
Walker-Turner Co., Inc.

**Punch**
Excelsior Tool & Machine Co.

**PROFILERS**
George Gorton Machine Co.

**PROPELLER PROFILERS**
Engineering & Research Corp.

**POWER HAMMERS**
Champion Blower & Forge Co.
Pettingell Machine Co.
Quickwork Company
Yoder Company

**PUNCHES & SHEARS**
Buffalo Forge Co.
Champion Blower & Forge Co.
Engineering & Research Corp.
Gammons-Holman Co.
John J. Normoyle Co.
Peck, Stow & Wilcox Co.
Quickwork Co.
W. A. Whitney Mfg. Co.
Widemann Machine Co.

**RIVETERS**
Cleveland Pneumatic Tool Co.
Hannifin Mfg. Co.
High Speed Hammer Co., Inc.
Penn Rivet Corp.

**SAWS & SAWING MACHINERY**
Champion Blower & Forge Co.
Cochrane-Bly Co.
DeWalt Products Corp.
Henry Disston & Sons
Etna Machine Co.

*(Continued on following page)*


# *What is* Corona*?

**Corona isn't new. It has been present in practically all mica aircraft spark plugs for years but it has only recently been discovered that corona definitely impairs engine performance. Corona impairs the spark at the gap because it is an electrical current leakage paralleling the center electrode.**

**Champion, however, has developed a coronaless, gas-tight, compression-proof mica aircraft spark plug that positively improves engine performance, eliminates missing and permits easier starting. These advantages are now obtainable in Champion Nocorona Spark Plugs and have raised performance standards to a new high degree.**

**Install a set of new Champion Nocorona Mica Aircraft Spark Plugs and see for yourself how much sweeter your engine will perform. Available in either radio shielded or unshielded types.**

**Contractor to U. S. Army Air Corps.**



* Corona is electrical current leakage within the mica insulation and paralleling the center electrode of the spark plug. It is visible through the translucent mica core and obviously impairs the spark at the gap.

CHAMPION NOCORONA MICA AIRCRAFT SPARK PLUGS

(*Continued from preceding page*)
J. A. Fay & Egan Co.
W. B. Mershon Company
Peerless Machine Co.
Racine Tool & Machine Co.
W. Robertson Machine & Foundry Co.
L. S. Starrett Company
Walker-Turner Co., Inc.
Wickes Bros.

**SCREW MACHINES**
Acme Machine Tool Co.
Foster Machine Company
Hardinge Bros., Inc.
National Acme Co.
New Britain-Gridley Mach. Co.
Potter & Johnson Machine Co.
Rivett Lathe & Grinder, Inc.
Warner & Swasey Company
Waterbury Farrell Fndry. & Mach. Co.

**SHAPERS**
Advance Machine Co.
American Tool Works Co.
Cincinnati Shaper Co.
Cochrane-Bly Co.
Gould & Eberhardt
Niles-Bement-Pond Co.
Potter & Johnson Machine Co.
Smith & Mills Co.
Walker-Turner Co., Inc.

**SHEARS**
Brown Machinery Co.
Buffalo Forge Co.
Champion Blower & Forge Co.
Cincinnati Shaper Co.
Niagara Machine & Tool Works
Peck, Stow & Wilcox Co.
Pettingell Machine Company

**STRAIGHTENERS**
E. Corey & Co.

**TAPPING MACHINES**
Baker Bros.
W. F. & John Barnes Co.
Fosdick Machine Tool Co.
W. Gateman Mfg. Co.
Kingsbury Machine Tool Corp.
Moline Tool Company
Rickers-Shafer Co.

**THREAD & THREAD CHASERS**
The Adams Company
Eastern Machine Screw Co.
Geometric Tool Co.
Rickers-Shafer Co.

**TOOLS**
Brown-McLaren Mfg. Co.
Champion Blower & Forge Co.
Continental Tool Works
Oilgear Company
Scully-Jones

**TUBE CUTTERS**
DeWalt Products Company

**CYLINDER BORING MACHINERY**
Cedar Rapids Eng. Co. of Del.

**TOOL GRINDERS**
Gisholt Machine Co.

**TURRET MACHINES**
Cleveland Automatic Mach. Co.

**UNISHEARS**
The Stanley Works

**WELDERS**
Federal Machine & Welder Co.
Lincoln Electric Company
Linde Air Products Co.
Smith Welding Eqpt. Co.
Thomson-Gibb Elec. Welding Co.

**(Wood Working)**

**BAND FILERS**
Champion Blower & Forge Co.
Crescent Machine Co.
Henry Disston & Sons, Inc.
Horn Device Mfg. Co.
Racine Tool & Mach. Co.
Walker-Turner Company, Inc.
J. D. Wallace & Co.

**BORERS**
Beach Manufacturing Co.
Crescent Machine Co.
Oliver Machinery Co.

**GRINDERS**
Crescent Machine Co.
Oliver Machinery Company
C. P. Porter Machinery Co.

**JOINTERS**
American Woodwkng. Mach. Co.
Beach Manufacturing Co.
Champion Blower & Forge Co.
Crescent Machine Co.
Heston & Anderson
Hutchinson Manufacturing Co.
Kent-Owens Machine Co.
Oliver Machinery Co.
C. O. Porter Machinery Co.
J. D. Wallace & Co.
Yates-American Mach. Co.

**LATHES**
Atlas Press Company
Crescent Machine Co.
Greenfield Tap & Die Corp.
Oliver Machinery Co.
C. O. Porter Machinery Co.
Walker-Turner Co., Inc.

**MOLDERS**
J. A. Fay & Egan Company

**MORTISERS**
Beach Manufacturing Co.
Oliver Machinery Co.

**PATTERN MAKERS' MACHINERY**
Mummert-Dixon Co.
Oliver Machinery Company

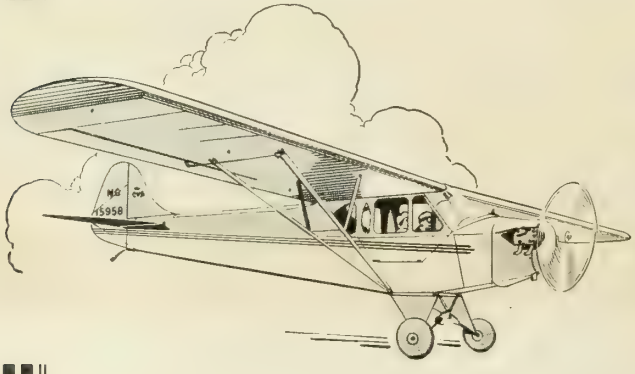
**PLANERS**
Champion Blower & Forge Co.
Cleveland Planer Co.
Crescent Machine Co.
G. A. Gray Co.
Kent-Owens Machine Co.
Oliver Machinery Co.
C. O. Porter Machinery Co.

**ROUTERS**
Oliver Machinery Co.
Onsurd Machine Co.
C. O. Porter Machinery Corp.
Reed-Prentice Corp.

**SANDERS**
Beach Manufacturing Co.
Hall & Brown Machine Co.
C. O. Porter Machinery Co.
Porter-Cable Mach. Co.
H. B. Smith Machine Co.
The Stanley Works
Sterling Products Co.

**SAWS**
Beach Manufacturing Co.
Beebe Bros.
Black Diamond Saw & Machine Wks., Inc.
DeWalt Products Corp.
Henry Disston & Sons, Inc.
Earl Gear & Machine Co.


# *The makers of the "Cub"...*



**—the Taylor Aircraft Company— gave Murphy aircraft finishes a thorough trial and test last year and liked them so well that they have given us an order for their entire requirements for 1937.**

## *They are particular*

**They are naturally very particular about the finishes they use. For beauty and durability, they must come up to the high standard of the airplane manufacturer that has the distinguished honor and merit of making 40% of all non-military planes during 1936.**

**We feature Aircraft Finishes and would be glad to serve you.**

**MURPHY VARNISH COMPANY**
**NEWARK CHICAGO SAN FRANCISCO**

Hall & Brown Machine Co.
Heston & Anderson
Hutchinson Manufacturing Co.
Independent Pneumatic Tool Co.
W. B. Mershon & Company
Oliver Machinery Company
C. O. Porter Machinery Company
Reed-Prentice Corporation
Sumner Iron Works
Walker-Turner Company, Inc.
J. D. Wallace & Company
Baxter D. Whitney & Son, Inc.
Yates-American Machine Co.

**SHAPERS**
Beach Manufacturing Co.
Buss Machine Works
New Advance Machine Co.
Oliver Machinery Co.
C. O. Porter Machinery Co.
Baxter D. Whitney & Son, Inc.

**SURFACERS**
Baxter D. Whitney & Son, Inc.

**TAPS**
Greenfield Tap & Die Corp.

**TRIMMERS**
Oliver Machinery Co.

## MISCELLANEOUS UNITS

**AIRBRUSHES**
DeVilbiss Company
Eclipse Air Brush Company
Passche Airbrush Company

**ANODIC TANKS**
Taylor Instrument Company

**BALANCING MACHINES**
Gisholt Machine Company
Sundstrand Mach. Tool Co.
Taft Peirce Manufacturing Co.

**BATTERY CHARGERS**
General Electric Company

**BLOWERS**
Champion Blower & Forge Co.
Pangborn Corporation
Standard Electric Tool Company

**BLOW PIPES, TIPS & GUNS**
American Gas Furnace Company
Cleveland Pneumatic Tool Co.

**BLUEPRINTING MACHINERY**
C. F. Pease Company
Wickes Brothers

**BOX NAILING MACHINES**
Food Machinery Corp.

**BURNERS**
Bellevue Industrial Furnace Co.

**CADMIUM PLATING EQUIPMENT**
Niagara Machine & Tool Works
Udylite Company

**CLAMPS**
Chas. E. Francis Co.

**CLOTH CUTTING MACHINES**
Eastman Machine Company

**CONTROLLERS**
General Electric Company
Leeds & Northrup Company
Taylor Instrument Company

**CORE WIRE MACHINES**
Worthington Pump & Mch. Corp.

**CRANES, HOISTS, TRUCKS, ETC.**
Baker-Raulang Company
Barrett-Cravens Company
Canedy-Otto Mfg. Co.
Canton Foundry & Mch. Co.
Coffing Hoist Company
Curtis Pneumatic Mchny. Co.
Detroit Electric Furnace Co.
Fairbanks Company
Harnischfeger Corporation
Peerless Machine Company
Roberts & Myers, Inc.

**COATING-PAINTING MACHINES**
Brunner Manufacturing Co.
Chas. E. Francis Company
Passche Airbrush Company

**COUNTERS & INDEXERS**
Kingsbury Machine Tool Co.

**CEMENT-GRINDING COMPOUNDS**
Gardner Machine Company
National Broach & Machine Co.

**DRYERS**
Gehnrich Corporation

**DUST COLLECTORS**
Pangborn Corporation

**EXHAUSTERS**
Champion Blower & Forge Co.
DeVilbiss Company
Pangborn Corporation
Standard Electric Tool Company

**FACTORY TRUCKS**
Chas. E. Francis Co.

**FILTERS**
Fostoria Pressed Steel Corp.

**FIRE BRICK**
Bellevue Industrial Furnace Co.

**FORGES**
American Gas Furnace Company
Buffalo Forge Co.
Champion Blower & Forge Co.
J. H. Knapp Company, Inc.

**FURNACES & OVENS**
American Gas Furnace Company
Bellevue Industrial Furnace Co.
Detroit Electric Furnace Co.
Electric Furnace Company
Foundry Equipment Company
Gehnrich Corporation
Hevi-Duty Electric Company
Hoskins Manufacturing Co.
C. I. Hayes
J. H. Knapp Company, Inc.
Leeds & Northrup Company
Strong, Carlisle & Hammond
Surface Combustion Company
Harold E. Trent Company
Young Brothers & Company

**SAND BLASTING EQUIPMENT**
Pangborn Corporation

**GAUGES, TESTING & MEASURING APPARATUS, COUNTERS**
John Bath & Co.
Detroit Electric Furnace Co.
Federal Products Corp.
Fellows Gear Shaper Co.
Hjorth Lathe & Tool Company
Leeds & Northrup Company
Lees-Bradner Company
Niles-Bement-Pond Co.
Stanley P. Rockwell Co.
L. S. Starrett Company
George Scherr Company
Toledo Scale Company
Wilson Mech. Inst. Co.

**GLUE POTS, MIXERS, SPREADERS**
Chas. E. Francis Company
General Electric Company

*(Continued on following page)*


# 1937 is 1939 to those who fly a Beechcraft

Sales in 1936 were MORE than double those of last year. This is the record of the BEECH AIRCRAFT CORPORATION for 1936.

We will not introduce into our standard line any so-called new models but a large portion of the increased profits is being used to further improve and REFINE our standard PROVED models and to assure a STILL GREATER increase in sales and service for 1937.

Our 1937 line will be augmented, by the addition of a twin engine, executive model, all-metal monoplane. This plane will be custom made so far as cabin appointments and accommodations are concerned. Passenger model will seat six passengers and two pilots comfortably. Extraordinary refinements in design and engineering render this ship outstandingly efficient and economical as well as the most luxurious plane yet presented to the market.



Wishing you a Prosperous New Year

Walter H. Beech

BEECH AIRCRAFT CORPORATION

6403 EAST CENTRAL WICHITA, KANSAS, U. S. A.




# CONTROL!

IMPORTANT in production, as it is in flight, *control* is the biggest factor in the manufacture of AERO SUPPLY products. For AERO SUPPLY aircraft parts and fittings are controlled 100% from mill to consumer —microscopically, physically and chemically.

The aircraft industry knows and appreciates that, which explains the preference of private, commercial and military aircraft manufacturers for AERO SUPPLY products. It explains, too, why no airplane or pilot fatality has ever resulted from the failure of an AERO SUPPLY product.

**Aircraft Bolts & Nuts**
**Turnbuckles**
**Clevis Pins**
**Conduit Clamps, Unions, & Nuts**
**Tube Clamps & Tube Clips**
**Shackles**
**Thimbles**
**Cable Bushings**
**Cable Splicing Clamps**
**Universal Joints**
**Ball Socket Joints**
**Taper Pins**
**Tie Rod Clevises & Terminals**
**Hose Clamps**
**Flanges**
**Trigger Motors**
**Fuel Cocks**
**Gun Control Switches**
**Strainers**
**Fuel Line Fittings**
**Impulse Unit End Assemblies**
**Fuel Pumps (hand type and motor driven)**
**Gun Mount Post Assemblies**
**Fuel Pump Drives & Couplings**
**Engine Controls**
**Fuel System Units**
**Control Stick Grips**

*Also hardened and ground aircraft fittings*

**AERO SUPPLY MFG. CO., INC.**
CORRY, PENNSYLVANIA

*Successors to*

**AERO SUPPLY MANUFACTURING CORP.**

(*Continued from preceding page*)

New Advance Machinery Co.
Oliver Machinery Company

**GLUE PRESSES**
Chas. E. Francis Company

**HEATERS**
American Gas Furnace Company
Champion Blower & Forge Co.
Gehnrich Corporation
General Electric Company

**HONING MACHINES**
Barnes Drill Co.

**HYDRAULIC JACKS, PRESSES**
American Chain Company
Rogers Products Company, Inc.

**IMPREGNATORS, ENAMELERS, FILTERS**
L. J. Barrett Company

**INSTRUMENTS**
John Bath & Co., Inc.
Blackman & Buetzel Mach. Co.
Federal Products Corp.
Leeds & Northrup Company

**LIGHTING EQUIPMENT**
General Electric Vapor Lamp Co.

**LUBRICATOR EQUIPMENT**
Rivett Lathe & Grinder, Inc.
W. W. & C. F. Tucker, Inc.

**MOTORS & TURBINES**
Atlas Press Company
Dumore Company
General Electric Company
Harnischfeger Corporation
Oliver Machinery Company
Speedway Manufacturing Co.

**MOUNTINGS**
R. G. Haskins Company

**PURIFIERS**
Alexander Milburn Company

**RECLAIMERS**
Sharples Specialty Company

**SEWING MACHINES**
Singer Sewing Machine Company
Union Special Machine Company

**SHARPENERS**
Barber-Colman Co.
Covel-Hanchett Co.

**SPRAY PAINTING BOOTHS & OUTFITS**
Binks Manufacturing Co.
Brunner Manufacturing Co.
DeVilbiss Company
Alexander Milburn Company
New England Blower Company
Passche Airbrush Company

**STANDS**
American Chain Company
Cedar Rapids Eng. Co. of Del.
Eclipse Aviation Corporation
Independent Pneumatic Tool Co.
Oliver Machinery Company
Skilsaw, Incorporated
Standard Electric Tool Co.
The Stanley Works
Walker-Turner Co., Inc.

**TESTING MACHINES**
Baldwin-Southwark Corp.
Jones & Lamson Machine Co.
Tinius Olsen Testing Mch. Co.
Scintilla Magneto Company
Toledo Scale Company
Wilson Mech. Instrument Co.

**TUMBLING BARRELS**
Globe Tapping Machine Company

**VENEER IRONING PRESSES**
Chas. E. Francis Company

**VISES**
Champion Blower & Forge Co.
Columbian Vise & Mfg. Co.

**WASH TANKS**
Southern Iron & Equip. Co.

**WIRE TIEING MACHINES**
Food Machinery Corp.

**X-RAY**
General Electric X-Ray Corp.
Magnaflux Corporation
St. John X-Ray Service, Inc.

## Manufacturers of Machinery for Aircraft and Engine Production

### A

**Abrasive Machine Co., Providence, Rhode Island**
Products:
Grinding machines.

**Acme Diamond Tool Company, 170 Broadway, New York, N. Y.**
Products:
Diamond pointed tools (wheels; dressers).

**The Acme Machine Tool Company, Cincinnati, Ohio**
C. H. M. Atkins, pres.; B. B. Quillen, vice-pres.; E. N. Atkins, secy.; Charles Meier, treas. & gen. mgr.
Products:
Lathes (turret). Screw machines.

**The Adams Company, Dubuque, Iowa**
Eugene Adams, pres.; Herbert Adams, secy.
Products:
Gear hobbers. Thread millers.

**Adriance Machine Works, Inc. Richards St., Brooklyn, N. Y.**
Products:
Presses (foot; hand).

**Advance Machine Co., Minneapolis, Minnesota**
Products:
Shapers (2-spindle).

**Albertson & Company, Sioux City, Iowa**
H. A. Jacobson, adv. mgr.
Products:
Valve grinding tools.

**Charles G. Allen, Barre, Mass.**
Products:
Drills (sensitive high-speed press; spindle; bench; overhang). Drill presses.

**American Broach & Machine Co., Div. Sundstrand Machine Tool Co. Ann Arbor, Michigan**
Hugo L. Olson, pres.; F. J. Lapointe, vice-pres.

Products:
Broaches. Hydraulic presses.

**American Chain Company, (Manley Mfg. Division) York, Pa.**
O. R. McDonald, sales mgr.
Branch offices:
New York; Boston; Chicago; York; San Francisco; Pittsburgh; Detroit.
Products:
Hydraulic equipment (jacks; presses; motor stands. (*Oct.*)

**American Gas Furnace Co., Elizabeth, New Jersey**
Products:
Furnaces (oven; melting; carburizing). Gas forges. Burners. Blowpipes and tips. Heating and continuous heat-treating machines.

**American Saw & Mfg. Co., Springfield, Massachusetts**
Products:
Hack saws. Accessories.

**The American Tool Works Co., Cincinnati, Ohio**
J. C. Hussey, vice-pres. in charge domestic sales.
Products:
*American* Lathes (tool room; multi-production). Drills (triple purpose radial; *Hole Wizard* radial). Shapers (tool room; manufacturing).

**American Twist Drill & Tool Co. 2804 W. Jefferson St., Detroit, Mich.**
Products:
Drills.

**American Woodworking Mach. Co., Rochester, New York**
Products:
Jointers.

**B. C. Ames Co., Waltham, Mass.**
Products:
Milling machines (bench).

**Apex Broach Co., Dayton, Ohio**
Products:
Stud drivers and setters.

**Armstrong Brothers Tool Co., 317 N. Francisco Ave., Chicago, Ill.**
Lennox F. Armstrong, pres.; John O. Armstrong, vice-pres.; J. J. Sutton, treas.; Horace Armstrong, sec., adv. & sales mgr.
Products:
*Armstrong* tool holders. Machinists tools.

**Atlas Press Company, Kalamazoo, Michigan**
G. C. Nancarrow, sales mgr.
Branch offices:
35 E. Wacker Drive, Chicago.
Products:
Lathes (metal; wood; attachments). Drill presses and attachments. Presses (hydraulic; mechanical). Motors. Arbor presses. (*Oct.*)

**The Automatic Machine Co., Bridgeport, Connecticut**
W. R. Webster, pres.; J. Coulter, vice-pres.; H. G. Emt, chief eng.; H. C. Irving, sales mgr.; T. R. Coulter, purchasing agent.
Products:
Diamond tool boring machines. Automatic threading chasing lathes. Shaping planers. Hob thread milling machines.

**M. E. Avery Co., Watertown, N. Y.**
Products:
Drilling machines (1 to 3 spindle; high-speed). Drill presses. Mill band cut-off machines. Attachments.

**Avey Drilling Machine Co., Cincinnati, Ohio**
Products:
Drills (1 to 6 spindle).

## B

**Baker-Raulang Company, Baker Industrial Truck Div., Cleveland, Ohio**
E. J. Bartlett, pres.; A. J. Gates, vice-pres. & gen. sales mgr.; H. H. Remde, gen. mgr.
Products:
Industrial trucks. (*Oct.*)

**Baker Bros., Inc., Toledo, Ohio**
Products:
Tapping machines. Accessories.

**Baldwin-Southwark Corp., Philadelphia, Pennsylvania**
G. H. Houston, pres.; W. H. Harman, vice-pres. & gen. mgr.; O. V. Kruse, gen. sales mgr.
Products:
Materials testing equipment (Southwark-Emery testing machinery; stress & strain recording and measuring apparatus).

**Barber-Colman Co., Rockford, Ill.**
Products:
Milling cutters. Reamers. Hobbing machines. Sharpening machines (reamers; hobbers).

**Bardons & Oliver, Inc., 1133 W. 9, Cleveland, Ohio**
Products:
Turret lathes. Cutting off machines.

**W. F. and John Barnes Company, Rockford, Illinois**
Products:
Drilling, boring, tapping and precision boring machinery for cylinders and crankcases.

**Barnes Drill Co., Inc., 814-830 Chestnut St., Rockford, Ill.**
J. E. Andress, pres. & treas.; A. M. Johnson, vice-pres. & chief eng. A. G. Block, secy.; Reed M. Andress, purchasing agent; R. S. Walker, sales mgr.; W. M. Fairbairn, supt.
Products:
Drilling machines (round and square column; sliding head; swing table; 1 to 6 spindle; box column). Drill presses. Honing machines (hydraulic).

**Barrett-Cravens Co., Chicago, Ill.**
A. M. Barrett, pres.; E. J. Heimer, vice pres., adv. & gen. sales mgr.
Products:
*Barrett* lift trucks and portable elevators. Racks.

**The Leon J. Barrett Co., Worcester, Massachusetts**
N. F. Holter, chief eng.; W. A. Hyde, director of research; C. F. Moss, enamel dept.; H. H. Wright, sales mgr.
Products:
Centrifugal machines (impregnators; enamelers; filters).

**The Bastian Blessing Co., 240 E. Ontario St., Chicago, Ill.**
L. G. Blessing, pres.; E. L. Mills, vice-pres. & sales mgr.
Products:
*Rego* welding and cutting equipment.

**John Bath & Company, Inc., Worcester, Massachusetts**
J. C. Bath, pres.; S. W. Bath, vice-pres.; E. A. Walker, chief eng.; O. F. Stromberg, supt.
Products:
High-speed ground thread taps. Precision instruments (thread gauges; *Bath* internal micrometers). Roll threading dies.

**Bausch Machine & Tool Co., 156 Wasen, Springfield, Mass.**
Products:
Multi-spindle drill presses.

**Beach Manufacturing Co., Montrose, Pennsylvania**
G. R. McKeage, pres. & gen. mgr.; B. F. McKeage, vice-pres. & treas.
Products:
Saws (cut-off [straight line; double; double arbor rip; combination rip; rip; carriage]; tilting [arbor; table type]; rip [self-feed; boxmakers]; gang dado and equalizing; scroll; band). Sanders (2-drum; hand-block belt; combination drum and disc; drum). Boring machines. Single spindle shapers. Hollow chisel mortisers. Jointers.

**Bellevue Industrial Furnace Co., 2971 Bellevue, Detroit, Mich.**
W. E. Hinz, gen. mgr.
Products:
Furnaces (gas fired tool room; gas fired pot; brass and aluminum melting and crucible heating). Fire brick. Oil

(*Continued on following page*)





*wins* 12 *NEW*

# WORLD'S RECORDS

AGAIN world records confirm Aeronca's preeminence in the light plane field. And again Aeronca Performance exceeds Promise. Out of the 33 official Certificates of Record issued by the National Aeronautic Association at Chicago to planes in **all** categories, AERONCA, America's foremost light plane, was awarded 12!

●HELEN RICHEY—Feminine International 100 Kilometer **Speed Record,** Fourth Category, Hampton Roads, Virginia, February 1, 1936, flying an Aeronca C-2 Scout Monoplane. Average Speed: 72.224 miles per hour.

●MR. AND MRS. TERRIS MOORE—International **Altitude Record,** for multi-seater, Third Category, at Boston, Massachusetts, February 1, 1936 flying an Aeronca C-3 Seaplane. Altitude: 11,558.364 feet.

●IONE COPPEDGE AND MRS. JOSEPHINE GARRIGUS—Feminine International **Altitude Record,** multi-seater, Third Category, at Dayton, Ohio, February 11, 1936, flying an Aeronca Monoplane. Altitude: 15,252.579 feet.

●BENJAMIN KING—International **Altitude Record,** Fourth Category, at Langley Field, Virginia, April 24, 1936, flying an Aeronca C-2 Scout Monoplane. Altitude: 17,939. 578 feet.

●BENJAMIN KING—International 500 Kilometer **Speed Record,** Fourth Category, Hampton Roads, April 26, 1936, flying an Aeronca C-2 Scout Monoplane. Average Speed: 74.717 miles per hour.

●HELEN RICHEY—Feminine International **Altitude Record,** Fourth Category, May 9, 1936, flying an Aeronca C-2 Scout Monoplane, Washington, D. C. Altitude 18,448.107 feet.

●ROBERT F. TURNER AND GEORGE E. CRAIG—International **Airline Distance Record** for multi-seater, Third Category, May 20, 1936, flying from Raleigh to Boca Raton, in an Aeronca C-3 Monoplane. Distance: 653.06 miles.

●WILSON L. MILLS AND CONSTANCE RIGHTER—International **Airline Distance Record,** for multi-seater, Third Category, May 27, 1936, Miami to Winston-Salem, in an Aeronca Monoplane. Distance: 717.061 miles.

●HELEN FRIGO AND HARRIETT SACKETT—Feminine International 100 Kilometer **Speed Record,** Third Category, at College Park, Maryland, June 12, 1936, flying an Aeronca C-3 Monoplane. Average Speed: 74.193 miles per hour.

●MARGARET BAIN TANNER—Feminine International 100 Kilometer **Speed Record,** Second Category, Hampton Roads, Virginia, August 8, 1936, flying an Aeronca Seaplane. Average Speed: 66.672 miles per hour.

●IRENE I. CRUM—International **Altitude Record,** Fourth Category, at Gallipolis, Ohio, August 23, 1936, flying an Aeronca C-2 Scout Monoplane. Altitude: 19,425.814 feet.

●HOWARD G. MAYES, JUNIOR—**Altitude Record** for junior pilots at Chesapeake, Ohio, September 6, 1936, flying an Aeronca C-2 Scout Monoplane. Altitude: 19.997 feet.

**Flash! At Miami Races, Karl Voelter, flying an Aeronca C-3, again decisively wins light plane race over all competition.**

**AERONAUTICAL CORPORATION OF AMERICA**

MAKERS OF 6 HIGH WING — AERONCA — LOW WING AERONCAS

**LUNKEN AIRPORT — CINCINNATI, OHIO**

(*Continued from preceding page*)
and gas burners. *Spencer* turbo-compressors. Oil pumps.

**Beebe Bros., Seattle, Wash.**
Products:
Jig saws.

**Biax Jarvis Manufacturing Co., Portland, Connecticut**
R. Wetzel, vice-pres.
Products:
Grinders (flexible shaft; bench). Rotary files. *Biax* high-speed tapping attachments.

**Bicknell-Thomas Company, Greenfield, Massachusetts**
Leon E. Turner, pres. & treas.; Clarence Fielding, supt.
Products:
Cutting tools (counterbores; countersinks; core drills; spotfacers). Tapping machines. Chucks.

**Bignall & Keller Machine Works, Edwardsville, Illinois**
Products:
Pipe threading machines. Die grinding machines.

**Bilgram Gear & Machine Works, Philadelphia, Pennsylvania**
Products:
Gears. Gear cutters. (*Ju.*)

**Binks Manufacturing Co., Chicago, Ill.**
J. F. Roche, pres.; S. Bramsen, vice-pres. & chief eng.; J. F. Roche, Jr., sales mgr.; E. F. Watts, adv. mgr.
Branch offices:
126 Lafayette St., New York; 2830 E. Grand Blvd., Detroit; 1412 S. Bway., St. Louis; 923 Harrison St., San Francisco; 15 Lombard St., Philadelphia; Chamber of Commerce Bldg., Pittsburgh; 2411 E. 26 St., Los Angeles.
Products:
Spray painting and finishing systems (Thor spray guns; spray gun accessories; finishing units; spray booths; hydrostatic gauges; reciprocating spraying machines). (*Oct.*)

**The Black & Decker Mfg. Co., Towson, Maryland**
S. Duncan Black, pres.; Alonzo G. Decker, vice-pres. & gen. mgr.; R. D. Black, sales mgr.; J. F. Apsey, Jr., adv. mgr.; F. H. Schell, sales.
Factories:
Towson; Toronto; Slough, Bucks, England; Sydney, Australia.
Branch offices:
319 Spring St., N. W., Atlanta; 48 Brookline Av., Boston; 31 Barker St., Buffalo; 2009 S. Michigan Av., Chicago; 2028 E. 22 St., Cleveland; 213 Henry St., Dallas; 708 18 St., Denver; 2818 E. Grand Blvd., Detroit; 2008 Grand Av., Kansas City, Mo.; 1421 S. Flower St., Los Angeles; 1012 Marquette Av., Minneapolis; 115 Sixth Av., New York; 545 E. 10 St., Oakland; 710 N. 16 St., Philadelphia; 2822 Locust St., St. Louis; 6030 Broad St., Pittsburgh; 349 Ninth St., San Francisco.
Products:
Portable electric tools (drills, torsimeters, sanders, valve seat grinders, valve refacers). Accessories. (*Oct.*)

**Black Diamond Saw & Mach. Works, Inc., Natick, Massachusetts**
Products:
Narrow band saws. Band saw filing and setting machines. Saw guides. Precision drill grinders.

**Blackman & Nuetzel Machinery Co., St. Louis, Missouri**
Products:
Machine tools.

**The Blanchard Machine Co., 64 State St., Cambridge, Mass.**
Henry K. Spencer, mgr.
Products:
Vertical surface grinders. Grinding wheels. Demagnetizers. Work washing attachments. Reaming machines.

**E. W. Bliss Company, 53rd & 2 Ave., Brooklyn, N. Y.**
Products:
Inclinable presses (consolidated power; punch; geared punch).

**J. G. Blount Co., Everett, Mass.**
Products:
Grinders. Motor driven speed lathes. Attachments.

**The Boye & Emmes Mach. Tool Co., Cincinnati, Ohio**
Products:
Lathes (heavy duty).

**Bradford Machine Tool Co. 657 Evans, Cincinnati, O.**
Products:
Special drills.

**Breeze Corporations, Inc., 24-46 S. Sixth St., Newark, N. J.**
J. J. Mascuch, pres.; A. L. Johnson, Jr., vice-pres.; J. F. Lucas, sales mgr.; S. H. Roberts, production mgr.; F. G. Gardner and M. M. Eells, aircraft engrs.
Products:
Swaging machines (hand; bench-type). (*A. Ju.*)

**Brown-McLaren Mfg. Co., Detroit, Michigan**
Products:
Reamers.

**Brown Machinery Company, 2323 N. 9 St., St. Louis, Mo.**
Products:
Lathes. *Pexto* shears and forming rolls. Presses.

**Brown & Sharpe Mfg. Co., Providence, Rhode Island**
H. D. Sharpe, pres. & treas.; H. Buker, vice-pres. & gen. sales mgr.; H. B. Shott.
Products:
Milling machines (horizontal; plain). Grinding machines (universal; tool; abrasive surface). Lathes (polishing; finishing). Bench centering machines. Gear hobbing machines. (*Ju. Oct.*)

**Brunner Manufacturing Co., 1821 Broad St., Utica, N. Y.**
G. L. Brunner, pres.; B. J. Scholl, secy. & sales mgr.; J. W. Thomas, asst. sales mgr.; H. E. Thompson, chief eng.
Products:
Spray painting equipment (guns; reducing valve assemblies; air conditioners). Air tools (engine cleaners; sprayers; blow guns). Air compressors. (*Oct.*)

**Bryant Chucking Grinder Co., Springfield, Vermont**
R. E. Flanders, pres.; W. J. Bryant, vice-pres.; J. B. Johnson, chief eng. & ass't mgr.; J. E. Stetson, treas. & mgr.; M. H. Arms, designing eng.; L. C. Gilchrist, sales eng.
Products:
Grinders (internal, hole and face).

**Buffalo Forge Co., Buffalo, N. Y.**
Products:
Bench drills. Forges. Shears. Punches. (*Oct.*)

**The Bullard Co., Bridgeport, Conn.**
E. P. Bullard, pres.; E. C. Bullard, vice-pres.; J. W. Bray, vice-pres. & dir. sales; E. P. Blanchard, sales mgr.
Products:
Vertical turret lathes (42"). Production machines (*Mult-Au-Matic* 6 and 8 spindle, 8" to 16").

**The Burke Machine Tool Co., Conneaut, Ohio**
Products:
Milling machines. Drill presses. Tapping machines and attachments.

**Buss Machine Works, Holland, Mich.**
M. Everett Dick, pres.; Eldon W. Dick, secy.-treas.
Products:
Electric woodworking machinery (surfacers; single and double shapers; single and double-spindle).

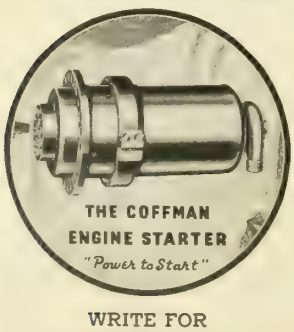
## C

**The Canton Foundry & Mach. Co., 6400 Breakwater Av., Cleveland, O.**
J. A. Buchers, sales mgr.
Products:
Portable floor cranes. Turntables.

**Carboloy Co., Inc., Detroit, Mich.**
W. G. Robbins, pres.; K. R. Beardslee, gen. sales mgr.; J. R. Longwell, chief eng.; District Mgrs.: W. W. Fullagar (Chicago); A. H. Godfrey (Cleve-








WRITE FOR
BOOKLET NO. 49

Many of the nation's leading aviation experts have enthusiastically endorsed the Coffman Starter to be the finest equipment that science has produced for starting airplane engines. It is Powerful, Economical, Safe and Absolutely Dependable under all weather conditions.

It permits the hauling of bigger "Pay Loads" because it eliminates excess storage batteries. The only electrical energy needed to ignite the cartridge in the breech, is one cell of a flashlight battery.

The Coffman Starter has a low maintenance cost and does not require additional personnel to assist in starting the engine. It is adaptable to single and multi-motored airplanes.

**FEDERAL LABORATORIES, INC.**
185 FORTY-FIRST STREET . . . . . PITTSBURGH, PENNA.

*Coffman Engine Starters and Cartridges are Fully Protected by Patents in United States and Foreign Countries.*

land); J. P. Peterson (Newark); L. J. St. Clair (Philadelphia); P. W. Weiser (Pittsburgh).
Branch offices:
Chicago; Cleveland; Newark; Philadelphia; Pittsburgh.
Products:
*Carboloy* tools (borers; facers; turners). Dies (*Carboloy* cemented). Wheel dressers (*Diamond Impregnated Carboloy*). Form, grooving and milling tools (cutters; reamers; end mills; counterbores; saws; drills; gauges; broaches; centers [lathes; grinders; valve stems and seats]; centerless grinder rests).

**Canedy-Otto Manufacturing Co., Chicago Heights, Illinois**
Branch offices:
407 Broome St., New York; 955 Folsom St., San Francisco.
Products:
Drill presses (motor-driven floor and bench type; single and multiple spindle). Arbor presses. Surface plates. Cranes.

**S. W. Card Manufacturing Co., (Div. Union Twist Drill Co.), Mansfield, Massachusetts**
J. W. Rathbun, mgr.; T. W. MacKay, works mgr.
Products:
Taps. Dies. Screw plates.

**The Carlton Machine Tool Co., Cincinnati, Ohio**
J. C. Carlton, pres. & gen. mgr.
Products:
Radial drills (heavy duty 3′ to 8′ arm).

**R. L. Carter Company, New Britain, Connecticut**
Products:
Hand type routers.

**Cedar Rapids Eng. Co. of Del., 902 17 Street, Cedar Rapids, Iowa**
R. H. Meister, pres.; T. M. Jones, vice-pres.
Products:
*Kwik-Way* cylinder boring machines. Grinders (piston; cam piston; valve seat). Valve facing machines. Valve reseating tools. Seat replacement tools. Cylinder adapter stands.

**Champion Blower & Forge Co., Lancaster, Pennsylvania**
C. B. Long, pres.; E. Donohoe, vice-pres.; Frank Groff, factory supt.
Products:
Engines; lathes (10″ to 16″). Drills (upright; bench). Forges. Blowers. Screw cutting lathes. Bench shears. Power hack saw machines. Steel punches. Power hammers. Arbor presses. Saws (bench; jig; circular and jointer; bench band). Thread cutting machines. Grinders and buffers. Bench planers and jointers. Vises. Angle benders. Screw dies and taps. Spring dies. Fans (blowers and exhaust; ventilating and automatic shutter). Fan unit heaters.

**Chicago Pneumatic Tool Co., Chicago, Illinois**
Products:
Air grinders. (*Oct.*)

**Chicago Wheel & Mfg. Co., 1101 W. Monroe St., Chicago, Ill.**
H. E. Miller, pres.; I. Danielson, vice-pres.; A. J. Miller, treas.; A. T. Dalton, sec., adv. & gen. sales mgr.
Products:
Grinding machines (*Handee*). Grinding wheels.

**The Cincinnati Bickford Tool Co., Cincinnati, Ohio**
Products:
Drilling machines (single and multiple spindle press; bench; radial press; plain radial).

**The Cincinnati Electric Tool Co., Cincinnati, Ohio**
Products:
Grinders.

**Cincinnati Milling Machine & Cincinnati Grinders, Inc., Cincinnati, Ohio**
Frederick V. Geier, pres.; W. W. Tangeman, vice-pres.
Branch offices:
2400 W. Madison St., Chicago; Marburg and South Sts., Cincinnati; 5005 Euclid Ave., Cleveland; New Center Bldg., Detroit; Chamber of Commerce Bldg., Pittsburgh.
Products:
Milling machines (universal L-type; plain and vertical high-speed dial type; plain automatic and hydromatic; duplex hydromatic). Duplex vertical hydrobroach machines. Grinders (universal tool and cutter; centerless; self-contained; plain hydraulic; roll; chucking). Centerless lapping machines. Hydraulic profile and die sinking machines. Milling machine attachments.

**The Cincinnati Shaper Company, Cincinnati, Ohio**
Perrin G. March, Jr., pres.; R. T. Hazelton, treas. & works. mgr.; H. S. Robinson, secy. & sales mgr.
Products:
Crank shapers (plain; universal). Press brakes. Squaring shears.

**The Cleveland Automatic Machine Co., Cleveland, Ohio**
W. F. Brown, pres.; A. L. Patrick, exec. vice-pres. & treas.; H. E. Nunn, vice-pres.; C. W. Cowdrey, sales mgr.
Branch offices:
565 W. Washington Blvd., Chicago; 30 Church St., New York; 2842 W. Grand Blvd., Detroit.
Products:
Turret machines (automatic single and multiple spindle).

**The Cleveland Planer Co., Cleveland, Ohio**
Products:
Planing machines.

**The Cleveland Pneumatic Tool Co., Cleveland, Ohio**
Claus Greve, chairman of the board; L. W. Greve, pres.; H. W. Foster, vice-pres.; A. F. Barner, sec.; J. DeMooy, treas.; S. Scott, supt.; E. W. Cleveland, mgr. automotive aircraft div.
Branch offices:
30 Church St., New York; 80 Federal St., Boston; 401 N. Broad St., Philadelphia; Clark Bldg., Pittsburgh; Insurance Exchange Bldg., Detroit; Railway Exchange Bldg., Chicago; Railway Exchange Bldg., St. Louis; 1306 N. First Av., Birmingham, Ala.; 1307 E. 17 St., Columbus, O.
Products:
Riveters (pedestal; bench; yoke). Hose fittings. Blow and spray guns. Air valves. Riveting hammers. Portable air drills and grinders, polishers. Dural riveters. Rotary sanders. Pneumatic starters. (*A. Oct.*)

**The Cleveland Twist Drill Co., 1242 E. 49 St., Cleveland, O.**
Francis E. Prentiss, chairman of the board; J. D. Cox, Jr., pres. & gen. mgr.; S. H. Cox, vice-pres.; Geo. F. Kast, secy.-treas.; W. E. Caldwell, sales mgr.; H. P. Jenson, asst. sales mgr.; Geo. W. Kohlmetz, purchasing agent.
Warehouses:
30 Reade St., New York; 9 N. Jefferson St., Chicago; 654 Howard St., San Francisco; 6515 Second Blvd., Detroit.
Products:
Drills (twist; carbon; high speed). Reamers (carbon; high speed). Counterbores (carbon; high speed). Countersinks (carbon; high speed). Milling machines (end; carbon; high speed). Screw extractors (*Ezy-Out*). (*Oct.*)

**The Cleveland Universal Jig Co., Cleveland, Ohio**
Products:
Universal drill jigs. Special fixtures.

**Cochrane-Bly Company, St. James St., Rochester, N. Y.**
Products:
Duplex universal vertical miller and shapers. Universal vertical milling machines. Universal vertical shapers. Circular tables. Metal sawing machines. High speed cutting-off machines. Automatic high speed saws. Automatic saw sharpening machines. Filing machines (bench; floor).

**Coffing Hoist Co., Danville, Ill.**
J. R. Coffing, sales mgr.
Products:
Hoists. (*Oct.*)

(*Continued on following page*)


# RECORD-MAKING AMPHIBIAN RELIES ON RCA!

*Setter of world's first amphibian speed mark equipped with RCA AVT-7 Transmitter and RCA AVR-7C Receiver!*



Off to make a record! The Essowing at start of its flight in May, 1935

ANOTHER of America's many fine airplanes using RCA Aviation apparatus is the Essowing, shown at the right. Owned and operated by the Standard Oil Company of New Jersey, this giant amphibian holds the distinction of setting the world's first speed record for planes of its type.

It was on May 15, 1935, the day of the Essowing's christening, that it went zooming through space on a 100 kilometer course to establish a record of 159.8 m. p. h. Since then, this sky and water ship has flown a total of 54,740 miles... 391 hours... constantly protected from sky hazards—ever enjoying great convenience—both the result of the RCA equipment aboard ... RCA AVT-7 Transmitter; RCA AVR-7C Receiver.

Every plane is a safer plane... every flight is more enjoyable... when you have RCA apparatus along with you. RCA makes a complete line of Aviation Radio equipment, including the new Radio Compass for planes, several types of Airport and Aircraft transmitters and receivers. Complete details without cost on request.

*RCA presents the Metropolitan Opera every Saturday afternoon. And "Magic Key of RCA" every Sunday, 2 to 3 P. M., E. S. T. Both on NBC Blue Network.*

RCA Aviation Radio Instruments are sold by AIR ASSOCIATES, INC., Glendale, Calif.; Chicago, Ill.; Garden City, L. I.; or write direct to Aviation Radio Section, RCA Manufacturing Co., Inc., Camden, N. J.

RCA

*for Aviation Radio*

A SERVICE OF THE RADIO CORPORATION OF AMERICA




1937 PREMIER

MARCH 13th to 21st

Seasoned exhibitors, inspired by the tremendous success of the 1936 show, have already made extensive reservations for space at the Second Annual Aircraft and Boat Show.

**The great all-year western exhibit will be represented by manufacturers, distributors, operators and executives from every branch of the aircraft and water craft industry.**

Build your business! Develop increased sales for 1937 in America's great western market! Present your product at extremely nominal cost to tens of thousands of prospective purchasers. The 60-foot doors of the centrally located and ideally planned Pan-Pacific Auditorium (110,000 square feet) permits placement of exhibit craft without dismantling.

Brilliant entertainment as well as a low admission fee will again assure a tremendous public attendance.

*FOR FULL INFORMATION ADDRESS CLIFFORD W. HENDERSON, MANAGING DIRECTOR, 7600 BEVERLY BLVD., LOS ANGELES*



PAN-PACIFIC AUDITORIUM, LOS ANGELES


*(Continued from preceding page)*

**Colcord-Wright Machinery Co., St. Louis, Missouri**
Products:
Lathes (*Monarch* 18").

**Colonial Broach Co., Detroit, Michigan**
Products:
Broaches.

**The Columbian Vise & Mfg. Co., 9021 Bessemer Ave., Cleveland, O.**
Dan C. Swander, pres. & gen. mgr.; H. F. Seymour, vice-pres. & sec. in charge of sales and adv.; A. F. Munhall, treas.
Products:
Vises.

**Cone Automatic Machine Co., Inc., Windsor, Vermont**
Products:
Lathes (*Conomatics* 7⅛" to 6"; universal multiple and splindle automatic). Attachments.

**Consolidated Machine Tool Corp., (Modern Tool Works Div.) Rochester, New York**
Products:
*Modern Magic* chucks and collets. Die heads (stationary; rotary). Collapsible taps. Stud setters. Inserted blade face milling cutters.

**Continental Mach. Specialties, Inc., Minneapolis, Minnesota**
R. J. Wilkie, vice-pres.
Products:
Sawing and filing machines (*Doall* combination die and die sinking and filing).

**Continental Tool Works, 5435 McGraw St., Detroit, Mich.**
Products:
Counterboring machines (spotfacers; backspotfacers). Core drills. Hollow milling machines. Reamers. Tools (high-speed; circular forming).

**E. Corey & Company, 65 W. Commercial, Portland, Me.**
Products:
Bench straightening machines.

**Covel-Hanchett Company, Big Rapids, Michigan**
Factories:
Benton Harbor; Big Rapids, Mich.
Branch offices:
2400 First Av., S., Seattle.
Products:
Knife grinders. Saw sharpeners, filers and setters. Saw and knife fitting machinery.

**The Crescent Machine Co., Leetonia, Ohio**
W. G. Bess, vice-pres.; J. H. Thompson (New York).
Branch offices:
90 West St., New York, N. Y.
Products:
Woodworking machines (saw tables; jointers; band saws; grinders; lathes; scroll saws; borers and mortisers; portable shapers; universal woodworkers; planers; swing cut-off saws).

**Curtis Pneumatic Mchy. Co., St. Louis, Missouri**
E. H. Steedman, chairman of board; Walter C. Hecker, pres.; Frank Ackerman, vice-pres. & works mgr.; John D. Lodwick, sales mgr.; L. C. Blake, adv. mgr.
Branch offices:
30 Church St., New York; 616 S. Michigan Av., Chicago; 1185 Mission St., San Francisco; Los Angeles.
Products:
Servicing equipment (air compressors; litts). (*Oct.*)

**The Cushman Chuck Company, Hartford, Connecticut**
Mgrs.: E. V. N. Myers (New York); A. L. Whittemore (Chicago); R. R. Vought (San Francisco).
Branch offices:
66 W. Broadway, New York; Monadnock Bldg., San Francisco; 15 N. Jefferson St., Chicago; 379 Kent St., Sydney, Australia.
Products:
Chucks (electric; hand-operated).

## D

**Davis Boring Tool Company, (Div. Larkin Packer Co.), 6200 Maple Av., St. Louis, Mo.**
Products:
Tools (expansion type boring). Cutters (expansion type boring and reaming). Reamers (expansion type machine and hand).

**Davis Keyseater Co., Rochester, New York**
E. A. Grenelle, mgr.
Products:
Keyseaters and cutters (straight; tapered).

**The Delta Mfg. Co., Milwaukee, Wisconsin**
H. E. Tautz, pres. & treas.; R. C. Beck, vice-pres.; M. Doyle, sec.; R. Melius, gen. sales mgr.
Products:
Drill presses. Woodworking machines (portable).

**Detroit Boring Bar Company, 690 E. Fort St., Detroit, Mich.**
Products:
Boring and reamer bars and cutters.

**Detroit Electric Furnace Co., 825 W. Elizabeth St., Detroit, Mich.**
Albert E. Rhoads, vice-pres.; E. P. Lovejoy, gen. mgr.
Products:
Electric furnaces and equipment (electrical apparatus; electrodes; refractories). Pyrometers. Hoists.

**Detroit Tap & Tool Co., Detroit, Michigan**
Products:
Taps.

**The DeVilbiss Co., Toledo, Ohio**
A. D. Gutchess, pres.; F. A. Bailey, vice-pres. & gen. mgr.; W. F. Gradolph, vice-pres. in charge sales; R. A. Guyer, sales mgr. spray equipment and compressor div.
Products:
Spray paint and finishing systems (air compressors; hose; spray guns; pressure feed paint tanks; spray painting outfits; attachments; portable exhaust fans; exhaust chambers).

**DeWalt Products Corporation, Fountain Av., Lancaster, Pa.**
Paul Gardner, pres.; A. R. Campbell, treas.; W. Ross Stevens, gen. mgr.; Walter Knapp, chief designing eng.
Products:
Power saws.

**Diamond Machine Company, 9 Codding St., Providence, R. I.**
Products:
Grinders (surface; face; wet tool; plain).

**Henry Disston & Son, Inc., Philadelphia, Pennsylvania**
Henry Disston, pres.; Frank Disston, Wm. D. Disston, S. Horace Disston, Jacob S. Disston, Jr., vice-presidents; David W. Jenkins, gen. sales mgr.; Ernest Query, mgr. sales, hardware dept.; Walter H. Gebhart, mgr. sales, industrial div.; Mark Harris, export sales mgr.
Branch offices:
Chicago; Detroit; Boston; New Orleans; Memphis; Bangor, Me.; Seattle; Portland, Ore.; Vancouver, B. C.; San Francisco.
Products:
*Disston* band saws (band knives; log band and band re-saws; narrow and wide saws). Circular saws (grooving; inserted tooth; solid tooth). Metal cutting saws (band; inserted and solid tooth). Fitted saws and tools. *Philbrick* cutter heads. (*Ju.*)

**Dries & Krump, Chicago, Ill.**
Products:
Brake bending machines.

**The Dumore Company, Racine, Wisc.**
L. J. LaMack, asst. sales mgr.; F. E. Broberg and S. E. Peters, electrical engineers; L. B. Augustine, sales mgr. in charge of tool div.; H. E. Nelson, tool design eng.
Branch offices:
100 Varick St., New York.

Products:
Portable flexible shaft tools (grinders; precision drills). Motors (polishing and buffing).

## E

**Earle Gear & Machine Co.,**
**4723 Stenton Ave., Philadelphia, Pa.**
Products:
Sawing machines.

**The Eastern Machine Screw Corp.,**
**New Haven, Connecticut**
B. P. Greene, pres. & gen. mgr.; C. W. Bettcher, vice-pres. & sales mgr.; T. W. Ryley, sec.-treas.
Products:
Die heads (self-opening). Threading machines.

**Eastman Machine Co.,**
**Buffalo, N. Y.**
Wade Stevenson, pres.; V. E. McCollum, asst. secy.
Branch offices:
85 Beach St., Boston; 1115 Broadway, New York; 626 Arch St., Philadelphia; 815 Van Buren St., Chicago; 86 Third St., San Francisco; 505 Iberville St., New Orleans; Box 713, Charlotte, N. C.; 159 Pryor St., S. W., Atlanta; 425 W. Jefferson Av., Detroit.
Products:
Portable cloth cutting machines.

**Eclipse Air Brush Co.,**
**79 Orange St., Newark, N. J.**
Products:
Air brushes and tanks.

**Eclipse Aviation Corp.,**
**East Orange, New Jersey**
Charles Marcus, pres.; R. P. Lansing, vice-pres.; H. A. Gossner, secy.; W. J. Buettner, treas.; C. H. Knoch, asst. secy-treas.; A. E. Raabe, sales mgr. & asst. secy.
Factories:
(Foundry division) Little Falls, N. J.
Products:
Starter and generator tool kits. Starter clutch test stands. [*A, Ju, Oct*].

**Eclipse Counterbore Company,**
**7410-30 St. Aubin Av., Detroit, Mich.**
R. G. Mitchell, gen. mgr.; J. E. MacArthur, sales mgr.; A. C. Warn, factory mgr.; U. G. Thomas, factory supt.
Products:
Interchangeable counterbores ([radical drive countersinks; cutters; sets and holders]; [pin drive cutters; countersinks; sets and holders]). Boring cutters (multi-diameter facing and chamfering tools). Miscellaneous tools (Welch Plug cutters and sets; two-piece core drills; inverted cutters; adjustable centers; integral pilot counterbores with tapered or straight shanks). Holders (stop collar radial or pin drivers; variable lengths; floating). Die sinking cutters. Spotfacers. Two-piece core drills. Special boring cutters for aircraft and engine production.

**The Electric Furnace Company,**
**Salem, Ohio**
R. F. Benzinger, vice-pres.; A. H. Vaughan, chief eng.; T. B. Bechtel, sales eng.
Products:
Furnaces (nitriding; copper brazing; annealing; heat treating; carburizing; enameling.

**Elliott & Stephens, St. Louis, Mo.**
Products:
Lathes.

**Chas. F. Elmes Engineering Wks.,**
**Chicago, Illinois**
Products:
Forcing presses.

**Engineering & Research Corp.,**
**Washington, D. C.**
Henry A. Berliner, pres. (engineering): James Lee Simmons, Frank B. Levy, Edward M. Bertran, Lee L. Marchant. W. T. Queen, factory mgr.; A. J. Moore, supt. of prod., propeller profiling dept.; Charles Snyder, airplane development dept. John D. Smoot.
Products:
*Erco* sheet metal formers. Propeller profiling machines. Automatic punch and riveting machines.

**Etna Machine Co., Toledo, O.**
Products:
Sawing machines.

**Errington Mech. Laboratory,**
**Staten Island, N. Y.**
Branch offices:
6047 N. Tallman Av., Chicago; 200 Broadway, New York; Old South Bldg., Boston.
Products:
Chucks (automatic drill; tap). Die heads. Tapping heads (multiple drilling).

**Ex-Cell-O Aircraft & Tool Corp.,**
**Detroit, Michigan**
N. A. Woodworth, pres. & gen. mgr.; Thor M. Olson, sales mgr.
Branch offices:
1807 Elmwood Ave., Buffalo; Penton Blvd., Cleveland; 522 Grand Av., Dayton; Dodge Bldg., New York.
Products:
Grinders (precision thread; carbide tool). Precision boring machines. Milling and drilling heads. Hydraulic power units. Special multiple equipment. Diesel fuel injection equipment. Special tools. Spindles (grinding; motorized). Drill jib bushings. (Continental Tool Works Div.): Broaches and broaching fixtures. Milling cutters. Counterbores. Core drills. Special tools. Reamers. Counterbore sets. Carboloy tipped tools. (*Ju.*)

**Excelsior Tool & Machine Co.,**
**East St. Louis, Illinois**
T. F. Philippi, pres.; P. M. Clement, secy.; W. S. Gemmer, supt.; F. Zoechling, chief draftsman.
Products:
Power punch presses.

## F

**The Fairbanks Company,**
**New York, N. Y.**
Geo. M. Naylor, pres.; James A. Cleary, treas. & gen. sales mgr.
Products:
Industrial trucks.

**Fay Automatic Mach. Tool Co.,**
**Springfield, Vermont**
Products:
Lathes (engine, 4 spindle automatic; special).

**J. A. Fay & Egan Company,**
**Oakley, Cincinnati, Ohio**
Products:
Molders. Saws. Woodworking machinery.

**The Federal Machine & Welder Co.,**
**Dana Ave., Warren, O.**
F. P. McBerty, pres.; Z. A. McBerty, sec.-treas.
Products:
Electric welders.

**Federal Products Corporation,**
**1144 Eddy St., Providence, R. I.**
Branch offices:
Daily News Bldg., Chicago; 10465 Carnegie Av., Cleveland.
Products:
Gauges. Measuring apparatus. Precision instruments.

**The Fellows Gear Shaper Co.,**
**Springfield, Vermont**
E. R. Fellows, pres. & gen. mgr.; W. D. Woolson, vice-pres.; E. J. Fullam, secy. & treas.; W. F. Slomer, gen. sales mgr. (Detroit); E. W. Miller, chief eng.; E. Stubbs, factory mgr.
Branch offices:
Fisher Bldg., Detroit.
Products:
Gear shapers (high speed; heavy duty). Generators (thread; hourglass). Gear burnishers. Gear lappers. Gear cutters. Clutch cutters. Lapping and measuring machines. Helical gear shaper cutters. Automatic gear inspection machines. Measuring machines (involute; gear).

**R. Y. Ferner Company,**
**Washington, D. C.**
Products:
Boring, drilling and milling machines (vertical).

**Ferracute Machine Co.,**
**Bridgeton, New Jersey**
Products:
Presses (foot; hand).

(*Continued on following page*)




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***Performance, Economy and Low Cost***

Taylorcraft is a practical plane for sport flying and training. It is low cost with modern design—dual wheel controls, unobstructed visibility and a 72 inch streamlined landing gear. This rugged plane has 80 m.p.h. cruising speed and 32 m.p.h. landing speed together with stability, maneuverability and ruggedness of more expensive and larger ships. It is absolutely the safest small plane in the field.

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(*Continued from preceding page*)

**Firth-Sterling Company,**
**710 W. Lake St., Chicago, Ill.**
Products:
Tungsten carbide tools.

**Fitchburg Grinding Machine Corp.**
**67 Walnut St., Fitchburg, Mass.**
Products:
Grinders.

**The Flather Co., Nashua, N. H.**
Products:
Engine lathes.

**Food Machinery Corp.,**
**(Nailing Machinery Div.),**
**Santa Ana, Calif.**
Hale Paxton, mgr.; Geo. M. Hill, asst. mgr.; Buster Paxton, eng.; Herbert Nicks, sales mgr.
Products:
Box nailing machines.

**The Foot-Burt Company,**
**13010 St. Clair, Cleveland, O.**
Products:
Drilling machines (single and multiple spindle; special). Drill presses.

**Fosdick Machine Tool Co.,**
**Cincinnati, Ohio**
Products:
Heavy duty upright drilling and tapping machines.

**Foster Machine Co., Elkhart, Ind.**
H. A. Moore, gen. sales mgr.
Products:
Turret lathes. Screw machines. Automatic chucking machines. *Foster-Barker Wrenchless* chucks and vises.

**Fox Machine Co., Jackson, Mich.**
Products:
Presses.

**Chas. E. Francis Co.,**
**Rushville, Indiana**
Geo. J. Griesser, pres.; M. A. Francis, vice-pres.
Products:
Glue pots. Mixers. Spreaders. Clamps. Presses (hand screw; hydraulic). Coating and painting machines. Factory trucks.

**The Fostoria Pressed Steel Corp.,**
**Fostoria, Ohio**
C. D. Pifer, pres. & gen. mgr.; R. J. Carter, secy. & treas.; C. W. McDaniel, gen. sales mgr.; Burtron Zook, sales promotion mgr.
Products:
*Fostoria* coolant filters. *Titeseal* sealing compound. Machine lamps. (*A*).

**Foundry Equipment Co.,**
**1833 Columbus Rd., Cleveland, O.**
Products:
Ovens (core; fuel; oil).

## G

**Gairing Tool Co., Detroit, Mich.**
Products:
Counterbores. Countersinks. Core drills. Reamers. Hollow mills. Floating holders. Facing heads. Form cutters. Boring bars and heads. Adjustable extension holders. Multiple diameter tools. Tungsten carbide-tipped tools.

**Gallagher Mfg. Co., Lynn, Mass.**
Products:
Shears.

**Gallmeyer & Livingston Co.,**
**Grand Rapids, Michigan**
Chas. H. Gallmeyer, pres.; S. Owen Livingston, vice-pres.; J. DeKoning, vice-pres.; B. C. Saunders, secy.; Wm. H. Gallmeyer, treas.
Products:
Grinders (surface; universal cutters and tool; twist drill; tap).

**The Gammons-Holman Co.,**
**Manchester, Conn.**
Products:
Punching and shearing machines.

**Gardner Machine Co., Beloit, Wisc.**
Products:
Grinders (disc; special flat surface). Abrasive discs and wheels. Lathes (polishing; buffing).

**W. Gatemann Mfg. Co.,**
**Manatowoc, Wisconsin**
Products:
Tapping machines (pneumatic oscillating).

**The Gehnrich Corp.,**
**Long Island City, N. Y.**
A. V. Maday, pres.; A. H. Sherman, vice-pres. & chief eng.; H. C. Hammer, supt.
Products:
Industrial ovens and dryers. Air heaters. Attachments.

**General Electric Company,**
**Schenectady, New York**
(Aeronautical section); J. C. Miller, mgr.; H. C. Ritchie and E. G. Haven. Aviation specialists; T. B. Jacocks (Washington); C. E. Anthony (New York); R. B. Ranson (Hartford); R. E. Johnson (Los Angeles); J. Bosway (Dayton).
Branch offices:
In principal cities.
Products:
Control apparatus (switches; starters; rheostats; controllers; contactors; relays; pressure governors; push button stations). Switchgear. Transformers. Voltage regulators. Capacitors. Instruments and meters. Electric welding equipment (electrodes; accessories). Heating equipment (box-type and continuous furnaces for hardening, annealing, carburizing and brazing; electric glue and soft-metal-melting pots). Dynamometers. (*A, Ju, Oct.*)

**General Electric Vapor Lamp Co.,**
**Hoboken, New Jersey**
District mgrs.: F. E. Keener (Atlanta); J. E. Watkins (Boston); J. F. Watkins (Bridgeport); C. N. Knapp (Charlotte); H. T. Braschler (Chicago); W. W. Becky (Cincinnati); R. V. First (Cleveland); G. R. Clover (Detroit); W. R. Flounders (Philadelphia); A. N. Martinson (Pittsburgh); Harry Coax (Rochester); E. J. Planert (St. Louis); J. T. Shannon (Hollywood); L. Kaufman (San Francisco).
Branch offices:
187 Spring St., N. W., Atlanta; 250 Stuart St., Boston; 955 Main St., Bridgeport, Conn.; 200 S. Tryon St., Charlotte, N. C.; 37 W. Van Buren St., Chicago; First National Bank Bldg., Cincinnati; 1365 Ontario St., Cleveland; Gen. Motors Bldg., Detroit; 424 Chestnut St., Philadelphia; 307 Fifth Av., Pittsburgh; 183 Main St., E., Rochester, N. Y.; 611 Olive St., St. Louis; Keese Engr. Corp., 7380 Santa Monica Blvd., Hollywood, and 557 Market St., San Francisco.
Products:
Industrial lighting equipment (*Cooper Hewitt* lamps; Type H mercury lamps; combination mercury-incandescent lamps). Special purpose lamps (for indicators; instrument panels).

**General Electric X-Ray Corp.,**
**2012 Jackson Blvd., Chicago, Ill.**
J. H. Clough, pres.; J. B. Wantz and W. S. Kendrick, vice pres.; E. W. Page, mgr. industrial sales.
Branch offices:
205 Spring St., N. W., Atlanta; 2420 S. 10 Av., Birmingham; 1001 Camp St., New Orleans; Medico-Dental Bldg., Los Angeles; Storik Bldg., Memphis; Hightower Bldg., Oklahoma City; 450 Sutter, San Francisco; 744 Francisco St., Los Angeles; Majestic Bldg., Denver; 205 E. 42 St., New York; 177 Church St., New Haven; 624 Beacon St., Boston; 3457 Walnut St., Philadelphia; 1726 Eye St., Washington, D. C.; 10 W. Case St., Baltimore; 909 St. Claire Av., Tampa; 421 Judge Bldg., Salt Lake City; Paulson Med. & Dent. Bldg., Spokane; 2012 Jackson Blvd., Chicago; 3724 Washington Blvd., St. Louis; Chamber of Comm. Bldg., Indianapolis; 2012 Jackson Blvd., Chicago; Heyburn Bldg., Louisville; 9 W. 8 St., Cincinnati; Des Moines Bldg., Des Moines; 1617 Dodge St., Omaha; 1114 Grand Av., Kansas City, Mo.; 121 Grace St., Richmond; Curtis Bldg., Detroit; Med. Arts. Bldg., Minneapolis; 940 W. St. Paul Av., Milwaukee; 965 Broad St., Newark; Medical Arts Bldg., Dallas; 75 State St., Albany; Chimes Bldg., Syracuse; Medical Arts Bldg., Rochester, N. Y.; 151 W. Mohawk St., Buffalo; 210 S. Church St., Charlotte, N. C.; 327 E. State St., Columbus, O.; 4900 Euclid Ave., Cleveland; Fulton


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Every room at the Montclair is an outside room, large, light, airy, comfortably furnished, and provides bath, shower and radio. SINGLE ROOMS $3, DOUBLE $4, DOUBLE WITH TWIN BEDS $4.50.

Bldg., Pittsburgh; Terminal Sales Bldg., Portland, Ore.; Electric Bldg., Houston; Smith-Young Tower Bldg., San Antonio; Medical Arts Bldg., Seattle. Victor X-Ray Corporation of Canada, Ltd., Medical Arts Bldg., Winnipeg, Man.; 570 Dunsmuir St., Vancouver, B. C.; Medical Arts Bldg., Montreal, Que.; 30 Bloor St., W., Toronto, Ont.
Products:
Industrial X-ray equipment and X-ray defraction apparatus.

**Genesee Mfg. Co., Rochester, N. Y.**
Products:
Inserted blade hollow mills.

**The Geometric Tool Company, New Haven, Connecticut**
J. W. Hook, pres.; J. W. Sneyd, vice-pres.; G. A. Denison, sales mgr.; A. F. Breitenstein, chief eng. & works mgr.
Products:
Threading machines. Die heads (self-opening; solid adjustable; circular and tangent chaser). Taps. Cutting tools.

**Giddings & Lewis Mach. Tool Co., 142 Doty, Fond du Lac, Wisc.**
H. B. Krant, pres. & gen. mgr.; Russell E. Hanson, 1st vice-pres.; F. W. Chadbourne, sec.; Carl Gebuhr, sales mgr.
Products:
Tools.

**Gisholt Machine Co., Madison, Wisconsin**
H. S. Johnson, pres.; F. W. Coombs and C. H. Johnson, vice-presidents; G. H. Johnson, vice-pres. & treas.; W. J. Hannum, sales mgr.
Branch offices:
2400 W. Madison St., Chicago; General Motors Bldg., Detroit; 1060 Broad St., Newark; 39 Montclair Dr., W. Hartford; 253 Sagamore Rd., Brookline, Upper Darby, Pa.; 1888 Page Av., Cleveland; 1914 N. 51 St., Milwaukee; 359 Kenilworth Av., Dayton.
Products:
Lathes (*Simplimatic* turret; precision and heavy duty, 10" to 32"). Balancing machines (dynamic; static). Universal tool grinders.

**Gleason Works, Rochester, N. Y.**
Products:
Bevel gear generators.

**Globe Tapping Machine Co., Bridgeport, Connecticut**
Products:
Tumbling barrel.

**Goddard & Goddard Co., 4724 Hastings, Detroit, Mich.**
Products:
Cutting tools.

**Gorham Tool Co., Detroit, Mich.**
Products:
High speed tools.

**George Gorton Machine Co., Racine, Wisconsin**
George Gorton, III, vice-pres.
Products:
Universal milling machines. Die duplicators. Engraving machines. Profilers.

**Goss & deLeeuw Machine Co., New Britain, Connecticut**
Products:
Chucking machines (4-spindle).

**Gould & Eberhardt, Newark, N. J.**
Products:
Milling machines (helical; spur). Shapers. Hobbing machines.

**Grand Mfg. & Machine Co., Bridgeport, Connecticut**
Products:
Drilling machines (upright; multiple spindle).

**Grand Rapids Machine Co., Grand Rapids, Michigan**
Products:
Drill grinders.

**The G. A. Gray Company, 3611 Woodburn Av., Cincinnati, O.**
J. F. Doran, sales mgr.
Products:
Milling machines. Planers (double housing; openside; milling; metal).

**Greaves-Klusman Tool Co., Cincinnati, Ohio**
Products:
Engine lathes.

**Greenerd Arbor Presses, Nashua, N. H.**
Warren L. Martin, gen. mgr.
Products:
Arbor presses (hand operated; motor driven; hydraulic).

**Greenfield Tap & Die Corp., Greenfield, Massachusetts**
E. C. Bailey.
Products:
Woodworking lathes. Taps. (*Oct.*)

## H

**Hall & Brown Machine Co., 1915 N. Broadway, St. Louis, Mo.**
Products:
Nibbling machines. Punch presses. Sanders. Rip saws.

**The Hall Planetary Co., Philadelphia, Pennsylvania**
P. Hall, pres.; H. C. Sheaffer.
Products:
*Planetary* milling machines.

**Hannifin Manufacturing Co., 621 S. Kolmar Ave., Chicago, Ill.**
V. W. Peterson, pres.
Products:
Portable hydraulic riveters (*Hy-power*). Special riveting machines.

**The Hanson-Whitney Machine Co., Hartford, Connecticut**
Products:
Thread millers and accessories. Taps

**Hardinge Brothers, Inc., Elmira, New York**
D. G. Anderson, pres.; L. R. Evans and D. R. Laux, vice-presidents; D. W. Strom, mechanical eng.
Branch offices:
544 W. Washington Blvd., Chicago; 2970 W. Grand Blvd., Detroit; 277 Lafayette St., New York.
Products:
Precision bench lathes (32" to 36"). Precision milling machines. Precision hand screw machines. Precision screw cutting lathes. Collets.

**Harnischfeger Corporation, Milwaukee, Wisconsin**
W. Harnischfeger, pres.; C. W. Daniels, gen. sales mgr.; L. F. Vonier, welder sales mgr.; G. L. Drake, hoist sales mgr.; H. Menck, works mgr.; B. Van Horn, crane sales mgr.
Branch offices:
20 N. Wacker Dr., Chicago; 2223 Commerce St., Dallas; Book Bldg., Detroit; 1714 Willow Av., Hoboken, N. J.; 1052 E. Bay St., Jacksonville; Dwight Bldg., Kansas City, Mo.; 2029 Santa Fe Av., Los Angeles; 307 S. Front St., Memphis; 4400 W. National Av., Milwaukee; Empire State Bldg., New York; 1385 Broad St. Station Bldg, Philadelphia; Farmers Deposit National Bank Bldg., Pittsburgh; 82 Beale St., San Francisco; 2911 First Av., S., Seattle; Tower Bldg., Washington, D. C.
Products:
Electric arc welders. Electric hoists. Electric motors. Cranes (electric overhead traveling; crawler).

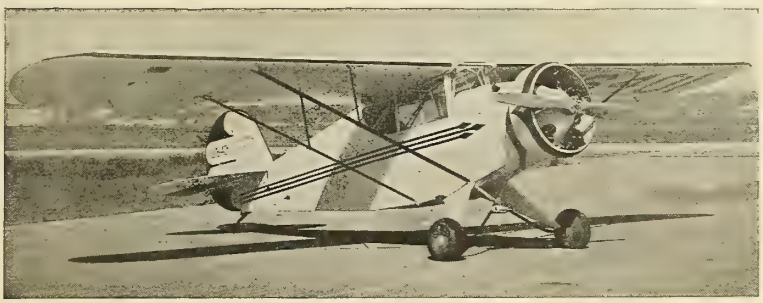
**Harron Rickard & McCone Co., San Francisco, California**
Products:
Milling machines.

**R. G. Haskins Co., Chicago, Ill.**
R. G. Haskins, pres.; E. P. Grismer, sales mgr.
Products:
Portable flexible shaft machinery (grinders and attachments; sanders; polishers; rotary files, screw drivers; nut setters). Flexible shafts. Mountings. Tapping equipment.

**Haynes Stellite Company, (Unit Union Carbide & Carbon), Kokomo, Indiana**
Branch offices:
230 N. Michigan Av., Chicago; 628 Keith Bldg., Cleveland; Gen. Motors

(*Continued on following page*)


★ ★ ★ ***Compare these proven* PORTERFIELD *facts***



***A Guarantee***

IN FOURTEEN COUNTRIES and most of the states PORTERFIELD AIRPLANES have proved definite superiority in speed, general performance, workmanship and in the high class materials used in their manufacture.

Official clocking at the Los Angeles Races proved definite superiority in speed, with exactly ten more miles an hour than PORTERFIELD's nearest competitor. PORTERFIELD is the only airplane selling for less than $4,000 which could qualify to enter the Amelia Earhart Trophy Race. This is only one of hundreds of examples of PORTERFIELD's superiority over any airplane selling for within more than $1,000 of its price. It has the best safety record of any airplane manufactured in America today.

Many very valuable territories are open for distributors who are or want to become the leaders in their respective territories.

Compare these facts with the fact that these remarkable airplanes are much less expensive to purchase than any airplane which begins to be a competitor, and write for our booklet which gives dozens of reasons why this is the best airplane in its price class, and in addition contains guaranteed performance data.

PORTERFIELD AIRPLANES are made by a manufacturer who has made, sold and delivered more than 1,000 airplanes. This should be sufficient proof that there are more than 1200 students learning to fly on these planes and the livelihood of more than two hundred families is being earned with them.

*Four Models . . . . $1295 to $2895*

**PORTERFIELD AIRCRAFT CORPORATION**

**2457 Charlotte Street** **Kansas City, Missouri**

*The major aeronautical event of the year—in the richest air market in America*

# SEE YOU AT THE AIR SHOW!

Every branch and department of the aviation industry is setting its course for the opening of the National Aviation Show in Grand Central Palace, January 28th! For ten days the Palace will be the home hangar of pilots, manufacturers, instructors, air line executives and thousands of prospective new members of our air minded fraternity.

Every kind of aviation exhibit will present the 1937 keynote of aerial progress on parade—aircraft, engines, accessories, newest technical devices, Government exhibits, airports and airways, schools, model aircraft and dozens of new advances.

Join the crowd of the nation's aeronautical leaders! They'll all be there! It'll be the greatest assembly of the industry in history—and everything timed to coincide with the meetings of leading organizations in aeronautics devoted to science, promotion and practical development.

MANUFACTURERS: This is your show for 1937. Join the parade! If you haven't already made your exhibition space reservation, wire at once to G. A. Parsons, Managing Director.




## NATIONAL AVIATION SHOW

GRAND CENTRAL PALACE

NEW YORK CITY

JAN. 28th to FEB. 6th, 1937

Under the auspices of Aviators' Post No. 743, The American Legion

Sanctioned by the Aeronautical Chamber of Commerce of America, Inc.

*(Continued from preceding page)*

Bldg., Detroit; 6119 Harrisburg Blvd., Houston; 2305 E. 52 St., Los Angeles; 30 E. 42 St., New York; 114 Sansome St., San Francisco; National Bank of Tulsa Bldg., Tulsa.
Products:
Metal cutting tools (bits [turning; boring; facing; reaming]; milling cutter blades; boring and reaming blades). Milling cutters (solid; mill; inserted tooth cutter blades). Burnishers. Counterbores. Facers (spot). Welding rods (Oxyacetylene).

**C. I. Hayes,**
**129 Baker, Providence, R. I.**
Products:
Furnaces.

**The Heald Machine Co.,**
**Worcester, Massachusetts**
Branch offices:
Chicago; Cleveland; Detroit; New York; Philadelphia; Syracuse.
Products:
Grinding machines (*Sizematic* and *Borematic*); internal; dry surface; cylinder; rotary surface). (*Oct.*)

**Hendey Machine Company,**
**105 Summer St., Torrington, Conn.**
Products:
Engine lathes. Milling machines.

**The Henry & Wright Mfg. Co.,**
**Hartford, Connecticut**
F. K. Simmons, pres.
Products:
Presses (drill; power; automatic).

**Heston & Anderson,**
**Fairfield, Iowa**
Products:
Jointers. Saws.

**Hevi Duty Electric Co.**
**Milwaukee, Wisconsin**
E. L. Smalley, pres.; H. E. Koch, vice-pres. & gen. mgr.
Branch offices:
205 W. Wacker Dr., Chicago; 26 S. 15 St., Philadelphia, 148 Crestwood Av., Buffalo; 2281 Scranton Rd., Cleveland; 90 Broadway, New York; 2832 Eastern Av., St. Louis; 825 W. Elizabeth St., Detroit; 216 S. Pennsylvania Av., Indianapolis; 37 Spear St., San Francisco; 1206 Maple Av., Los Angeles.
Products:
Electric heat-treating furnaces.

**The High Speed Hammer Co., Inc.,**
**Rochester, N. Y.**
Products:
Riveters (high-speed).

**The Hisey-Wolf Machine Co.,**
**Cincinnati, Ohio**
Products:
Electric drills. Grinders. Buffers.

**Hjorth Lathe & Tool Co.,**
**12 Beacon St., Woburn, Mass.**
Henrick J. Hjorth, pres. and gen. mgr.
Products:
Precision bench lathes. Spring winders. *B-ver* expansion reamers. Gauges (micrometer depth; drill angle testing; micrometer surface). Attachments.

**Hoefer Manufacturing Co.,**
**20 Liberty St., Freeport, Ill.**
Products:
Multiple drill heads (fixed; adjustable)

**Horn Device Mfg. Co.,**
**Kenmore, Ohio**
Products:
Power band saw.

**Hoskins Manufacturing Co.,**
**4435 Lawton Ave., Detroit, Mich.**
Products:
Furnaces.

**Hutchinson Manufacturing Co.,**
**Pittsburgh, Pennsylvania**
Products:
Combination saws and jointers.

**Hydraulic Press Manufacturing Co.,**
**Mount Gilead, Ohio**
Frank B. McMillin, pres.; Howard F. MacMillin, vice-pres. & gen. mgr.; A. L. Boggs, asst. gen. mgr.; W. C. Batchelor, sec. & treas. Representatives: Reider Thoreson (Detroit); Don C. Youngblood (Chicago); W. H. Herr (New York).
Branch offices:
Curtis Bldg., Detroit; 201 N. Wells St., Chicago; 30 Vesey St., New York.
Products:
Presses (*Hydro-Power* closed circuit; two-stage). Generators.

## I

**Ideal Machinery Co.,**
**Plainville, Connecticut**
Products:
Engine lathes.

**Independent Pneumatic Tool Co.,**
**Chicago, Illinois**
N. C. Hurley, pres.; R. S. Cooper, G. H. McCrae, F. B. Hamerly and W. A. Nugent, vice-presidents.
Branch offices:
915 N. 7 Av., Birmingham; Little Bldg., Boston; Genesee Bldg., Buffalo; 1740 E. 12 St., Cleveland; Garfield Bldg., Detroit; 6200 E. Slauson Av., Los Angeles; 342 N. Water St., Milwaukee; 330 W. 42 St., New York; 401 N. Broad St., Philadelphia; 320 Penn Av., Pittsburgh; 408 Pine St., St. Louis; 290 Seventh St., San Francisco.
Products:
Portable electric and air tools (*Thor* drills; screw drivers; nut setters; saws; grinders; hammers). Electric bench grinders. Drill stands. Centering devices. Angle attachments.

**The Ingersoll Milling Machine Co.,**
**Rockford, Illinois**
Products:
Automatic milling machines.

**Ingersoll-Rand Company,**
**11 Broadway, New York, N. Y.**
Geo. Doubleday, pres.; W. R. Grace, vice-pres.; L. B. Abrams, gen. sales mgr.
Products:
Riveters. Pneumatic machinery. (*Oct.*)

## J

**Jones & Lamson Machine Co.**
**Springfield, Vermont**
R. E. Flanders, pres.; K. H. Woolson, vice-pres.; J. E. Lovely, chief eng.
Branch offices:
2832 E. Grand Blvd., Detroit; 2400 Madison Av., Chicago.
Products:
Lathes (*Fay* automatic 8" to 24"; turret). Automatic double end milling and centering machines. Automatic dies (radial; tangential). Optical inspection machines (comparators; measuring). Automatic grinders (thread).

## K

**Kearney & Trecker Corp.,**
**Milwaukee, Wisconsin**
Theodore Trecker, pres.; Philip Edwards, vice-pres.; G. L. Erwin, gen. sales mgr.
Products:
Milling machines and attachments. Tungsten carbide cutters and cutter grinders.

**Kelly Reamer Co.,**
**Cleveland, Ohio**
Products:
Bars (boring; reamer).

**Kent-Owens Machine Co.,**
**958 Wall St., Toledo, Ohio**
W. S. Walbridge, chairman of board; W. J. Donkel, pres. & gen. mgr.; W. S. Rohr and E. G. Schill, vice-presidents; G. P. Greenhalgh, treas.; R. F. Wieland, secy. & asst. treas.
Products:
Milling machines. Special machinery.

**James H. Knapp Company, Inc.,**
**Los Angeles, California**
James H. Knapp, pres.
Products:
Furnaces (tool; heat treating; carburizing; nitriding). Forges.

**W. B. Knight Machine Co.,**
**Lucas Ave., St. Louis, Mo.**
Products:
Milling machines.

**Kingsbury Machine Tool Corp.**
**Keene, New Hampshire**
E. J. Kingsbury, pres. and treas.; G. Swahnberg, vice-pres.
Products:
Drilling machines (production semi-automatic; automatic). Automatic indexing machines for drilling, milling, threading. Automatic tapping machines. Center column type machines. Adapter units.

**Kutmore Tool Company,**
**841 Lake Av., Rochester, N. Y.**
Geo. Reisinger, gen. mgr.; Geo. Reisinger, Jr., chief eng.; L. Tardier, purchasing agent.
Products:
Adjustable hollow mills (high speed with micrometer adjustment). Turrets (lathes).

## L

**Landis Machine Co.,**
**Waynesboro, Pa.**
Products:
Thread chasers. Dies. Die heads.

**Landis Tool Co., Waynesboro, Pa.**
Branch office:
Detroit; Chicago; Newark; Philadelphia.
Products:
Precision grinders (cam; crank pin; piston; valve face; plain; universal; internal; oscillating).

**Langelier Mfg. Co.,**
**Providence, R. I.**
Products:
Semi-automatic drills.

**La Pointe Machine Tool Co.,**
**Hudson, Massachusetts**
Products:
Broaches.

**La Salle Machine Works,**
**Chicago, Illinois**
Products:
Small punch presses.

**The R. K. LeBlond Machine Tool Co.**
**Cincinnati, Ohio**
R. K. LeBlond, pres.; W. F. Groene, vice-pres. & chief eng.; H. C. Pierle, secy. & sales mgr.; R. E. LeBlond, works mgr. Representatives: B. N. Brockman (Chicago); W. E. Groene (New York).
Branch offices:
20 N. Wacker Dr., Chicago; 103 Lafayette St., New York.
Products:
Lathes (*Multi-Cut* 6" to 12"; *Eleven Inch* rapid production; automatic 12" to 16").

**Leeds & Northrup Company,**
**4970 Stenton Av., Philadelphia, Pa.**
Branch offices:
Boston; Chicago; Cleveland; Detroit; Hartford; Houston; Los Angeles; Pittsburgh; St. Louis; San Francisco; Tulsa.
Products:
Electric heat-treating furnaces. Temperature recorders and controllers (*Micromax*). Potentiometers. Wheatstone bridges. Galvanometers. (*A*).

**The Lees-Bradner Co.,**
**Cleveland, O.**
H. T. Bradner, pres.; W. A. McCarrell, sales mgr.; C. H. Schurr.
Products:
Hobbers (production gear; multiple spindle rotary automatic; single spindle automatic). Generators (gear; worm gear). Thread millers (standard; collet; super duty). Universal gear tooth grinder. Testers (gear; lead or helix angle).

**Lehman Machine Co., St. Louis, Mo.**
Products:
Engine lathes.

**Leland-Gifford Company,**
**Worcester, Massachusetts**
W. H. Leland, pres.; S. Nikoloff, vice-pres.; A. J. Gifford, treas.
Branch offices:
Boston; Chicago; Cleveland; Detroit; New York; Pittsburgh; Rochester.
Products:
Drilling machines (single-and multiple-spindle; press; gang press). (*Ju.*)

**The Lincoln Electric Co.,**
**12818 Coit Rd., Cleveland, O.**
J. F. Lincoln, pres.; J. C. Lincoln, chairman of board; C. M. Taylor, sales mgr. & vice-pres.; A. F. Davis and J. W. Meriam, vice-presidents.
Products:
Welders and welding equipment (arc; *Shield-Arc*). Motors (*Linc-Weld*).

**The Linde Air Products Co.,**
**(Unit Union Carbon & Carbide Co.)**
**30 E. 42 St., New York, N. Y.**
Branch offices:
282 Spring St., Atlanta; 532 E. 25 St., Baltimore; 1001 S. 22 St., Birmingham; Old South Bldg., Boston; 956 Main St., Buffalo; 820 S. Montana St., Butte; 2 Virginia St., Charleston, W. Va.; Carbide & Carbon Bldg., Chicago; B. F. Keith Bldg., Cleveland; 2626 Commerce St., Dallas; Gen. Motors Bldg., Detroit; 2101 Blake St., Denver; 416 Texas St., El Paso; 6119 Harrisburg Blvd., Houston; 16 & Main Sts., Indianapolis; Carbide & Carbon Bldg., Kansas City, Mo.; 2305 E. 52d St., Los Angeles; 48 W. McLemore Av., Memphis; First Wisconsin Natl. Bank Bldg., Milwaukee; 422 Washington Av., N., Minneapolis; 828 Howard Av., New Orleans; Carbide & Carbon Bldg., New York; 1421 N. Broad St., Philadelphia; 341 W. Buchanan St., Phoenix, Ariz.; 305 Ross St., Pittsburgh; 1427 N. W. Davis St., Portland; 4228 Forest Park Blvd., St. Louis; 362 Pierpont Av., Salt Lake City; Adam Grant Bldg., San Francisco; 2901 First Av., S., Seattle; 2011 Maxwell Av., W., Spokane; 320 S. Boston Av., Tulsa.
Products:
Welders and welding apparatus (oxygen; carbide; acetylene; oxy-acetylene [generators; cutters]; fluxes; etc.).

**Lodge & Shipley Mach. Tool Co.,**
**Cincinnati, Ohio**
M. G. Lodge, pres.; J. W. Carrel, vice-pres. & gen. mgr.
Products:
Lathes (manufacturing; automatic, precision, 14" to 36"). Attachments.

**Logansport Machine Company,**
**Logansport, Indiana**
Products:
Air chucks. Air cylinders.

**Lucas Machine Tool Co.,**
**523 E. 99 St., Cleveland, O.**
Products:
Boring mills (horizontal).

## M

**McCrosky Tool Corp.,**
**Meadville, Pennsylvania**
Products:
Reamers.

**Madison Mfg. Co., Muskegon, Mich.**
Products:
Bars (boring; reamer).

**Magnaflux Corporation,**
**25 W. 43rd St., New York, N. Y.**
A. V. deForest, pres.; F. B. Doane, vice-pres. & treas.; C. A. McCune, sec.
Branch offices:
333 N. Michigan Av., Chicago.
Products:
X-ray equipment.

**Manning, Maxwell & Moore,**
**100 E. 42nd St., New York, N. Y.**
Products:
Drilling machines (vertical).

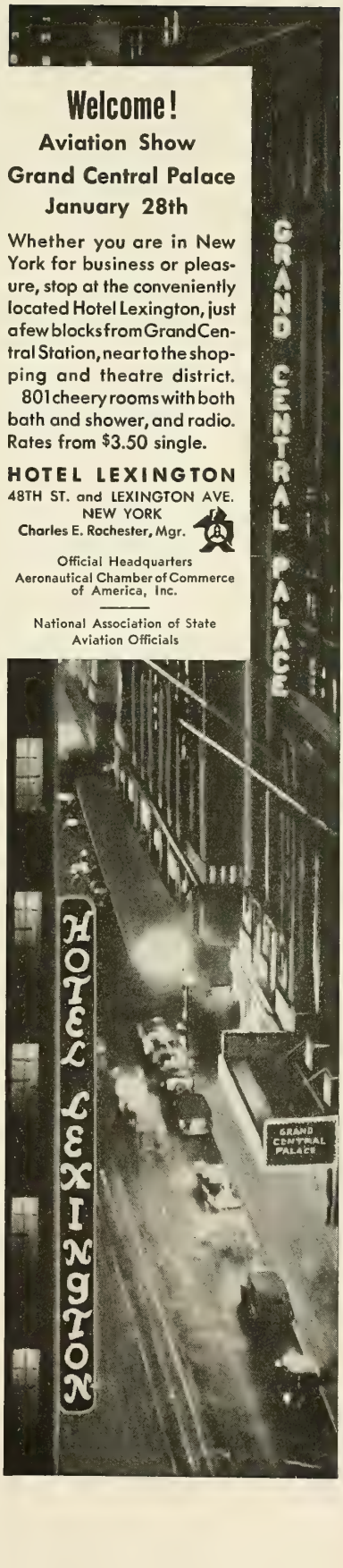
**Mattison Machine Works,**
**Rockford, Illinois**
A. M. Mattison, pres.; C. L. Mattison, treas.
Products:
Grinding machinery (surface; internal tube; sheet metal; strip).

**W. B. Mershon Co., Saginaw, Mich.**
C. J. Marshall, gen. mgr.
Products:
Sewing machinery (band; circular).

**Michigan Tool Company,**
**147 Jos. Campau St., Detroit, Mich.**
Products:
Hobbers (spline). Circular forming tools.

**Micro-Westco, Inc., Bettendorf, Ia.**
E. J. Bettendorf, pres. & treas.; W. E.

(*Continued on following page*)

(*Continued from preceding page*)
Bettendorf, vice-pres. & sec.; R. F. Valentine, vice-pres. & gen. mgr.; F. S. Main, vice-pres.; O. F. Rohwedder, vice-pres.; A. J. Bettendorf, asst. sec. & asst. treas.; H. H. Moor, sales mgr., Grinder Div.
Branch offices:
90 West St., New York; 1420 Chestnut St., Philadelphia; 500 N. Dearborn, Chicago; 318 E. 3 St., Los Angeles; 560 7 St., San Francisco.
Products:
Cylinder grinders. Pumps (water cooling; circulating).

**The Alexander Milburn Co., Baltimore, Maryland**
A. F. Jenkins, pres. & treas.; Wm. Patterson, sales promotion dept.; C. R. Heckler, factory supt.; J. G. Henderson, eng.; J. A. Griffith, tool room foreman.
Branch offices:
Bourse Bldg., Philadelphia; 130 W. 42 St., New York; 50 Terminal St., Boston.
Products:
Welding and cutting apparatus (Oxyacetyle; cutting and welding tips). Paint spray equipment. Portable carbide lights. Air and gas purifiers. (*Oct.*)

**Millersburg Reamer & Tool Co., Inc., Millersburg, Pennsylvania**
Products:
Reamers.

**Minister Machine Co., Minister, O.**
Products
Heavy duty drilling machines.

**Mitts & Merrill, Saginaw, Mich.**
M. H. Stimson, pres.
Products:
*Giant* keyseater.

**Modern Tool Works, Rochester, New York**
Products:
Chucks. Collets. Die heads. Taps. Milling cutters. Stud setters.

**Moline Tool Co., Moline, Ill.**
Products:
Drilling, boring, reaming, tapping and honing machines (multiple spindle). Special machines.

**The Monarch Machine Tool Co., Sidney, Ohio**
W. E. Whipp, pres.; F. C. Dull, vice-pres.; P. A. Abe, works mgr.; C. A. Bickel, chief eng.
Products:
Lathes (engine [12" to 36" inclusive]; tool room [12" to 18" inclusive]; manufacturing; semi-automatic; double carriage automatic; specially tooled, production and single purpose; Monarch *Keller* automatic form turning).

**George E. Moore, 44 Farnsworth St., Boston, Mass.**
Products:
Presses.

**Morris Machine Tool Co., Cincinnati, Ohio**
Products:
Drilling machines (*Mor-speed* radial; heavy duty).

**Morse Twist Drill & Machine Co., 163 Pleasant, New Bedford, Mass.**
W. T. Read, vice-pres., treas. & gen. mgr.; F. O. Lincoln, gen. sales mgr.
Products:
Drills. Taps. Dies. Cutters. Reamers.

**Motch & Merryweather Machine Co., Cincinnati, Ohio**
Products:
Radial drills.

**Muchey Machine & Tool Co., 952 Porter St., Detroit, Mich.**
Products:
Grinding machines.

**Mummert-Dixon Co., Hanover, Pa.**
E. S. Mummert, pres. & gen. mgr.; L. W. Rohrbaugh, vice-pres.; J. W. Rohrbaugh, director; D. H. Frock, sales.
Products:
Grinders (portable radial; tool; suspended). *Bulldog* boring heads. Spot facing tools. Facing heads. Pattern making machinery.

## N

**National Acme Co., Cleveland, O.**
Products:
Automatic screw machines.

**National Broach & Machine Co., 11455 Shoemaker, Detroit, Mich.**
Products:
*Red Ring* gear finishing and gear lapping machines. Gear speeders. Universal gear measuring machines. Broaching tools. Compounds (oil; water lapping).

**National Machine Tool Co., Spring Grove Ave., Cincinnati, O.**
Products:
Drilling machines (*Natco* multi; automatic).

**The National Machinery Co. Tiffin, Ohio**
Products:
Forging machines. Presses (forging; coining). Headers (hot; semi-hot; cold). Tapping machines (nut; automatic; semi-automatic).

**National Tool Co., Cleveland, O.**
Products:
Chucks (automatic; quick changing).

**National Twist Drill & Tool Co., Detroit, Michigan**
C. J. Oxfords, chief eng.
Branch offices:
New York; Chicago; Philadelphia; Cleveland; Tap and Die Division:

**The New Advance Machinery Co., Van Wert, Ohio**
Products:
Wood shapers. Electric glue pots.

**The New Britain-Gridley Mach. Co., New Britain, Conn.**
H. H. Pease, pres. & treas.; E. L. Steinle, vice-pres. & sales mgr.; D. H. Montgomery, vice-pres. & chief eng.; R. S. Hose, vice-pres. & asst. treas.
Branch offices:
Gen. Motors Bldg., Detroit; 2400 W. Madison St., Chicago.
Products:
Chucking machines and chucking units (automatic; hydraulic). Automatic-type machines (screw; tube).

**Newark Gear Cutting Machine Co., 69 Prospect St., Newark, N. J.**
Products:
Gear cutting machines.

**New England Blower Co., Hartford, Connecticut**
Products:
Spray booths.

**Niagara Machine & Tool Works, Buffalo, New York**
Managers: H. D. Rosenkrans (New York); R. J. Caplin (Detroit); Preston A. Rebok (Philadelphia).
Branch offices:
50 Church St., New York; Gen. Motors Bldg., Detroit; 5518 Morris St., Philadelphia.
Products:
Power presses. Shears (power squaring; rotary). Machines and tools for plate and sheet metal work.

**W. H. Nicholson & Co., Wilkes-Barre, Pennsylvania**
Products:
Mandrels.

**Nielsen, Inc., Lawton, Mich.**
W. W. Gairing, mgr. & chief eng.
Products:
Centers, tail stock spindles for lathes, grinders and other tools.

**Niles-Bement-Pond Co., (Pratt & Whitney Div.), Hartford, Connecticut**
C. R. Burt, pres. & gen. mgr.; W. P. Kirk, vice-pres. in charge sales; H. D. Tanner, mgr., machinery div.; C. M. Pond, mgr. small tool & gage div.; A. S. Keller, mgr., Keller Div.; A. H. d'Arcambal, sales mgr. small tool & gage div.; H. H. Wallace, purchasing agent.
Branch offices:
564 W. Monroe St., Chicago; 2 Av.


# BABB AIRCRAFT SALES

INTERNATIONAL AIRCRAFT BROKERAGE ● U. S. EXPORT LICENSE NO. 124

## ENGINES:

**CYCLONES, Model SR1820-F2,** new, 735 H.P. List price $8120; net each. $6000

**CYCLONE, Model SR1820-F52,** 820 H.P. Same as new. List price $8600; net ..... 6000

**CYCLONE, Model SR1820-F1,** 650 H.P. Practically new ..... 3000

**HORNETS, Model 1860B,** geared, 575 H.P. 38 hours total time. Each.. 1000

**HORNETS, Model 1860B,** direct drive, 575 H.P. Under 50 hours total time; overhauled and modified by P&W distributors. Each..... 1650

**HORNETS, Model 1690A,** 525 H.P. Under 400 total hours; overhauled and modified by P&W distributors. Each ..... 1000

**WASP SD**—500 H.P. Under 100 total hours. Overhauled by P&W Factory. Equipped with controllable propeller ..... 2500

**WASP SC1's**—450 H.P. Under 500 total hours; overhauled and modified by P&W distributors. Each.... 1650

**WASP C's**—420 H.P. Under 500 total hours; overhauled and modified. Each ..... 1350

**WASP B's**—420 H.P. Under 600 total hours; overhauled and modified. Each ..... $850

**WRIGHT R975-A's,** with D modifications — 330 H.P. Under 400 total hours; majored and guaranteed by factory distributors. Each ..... 1250

**WRIGHT R760-E's** — 250 H.P. Majored and modified by Wright distributors. Each ..... 1250

**WRIGHT J-5's**—220 H.P. Moderate usage; majored. Each ..... 500

**KINNER B-5**—125 H.P. Newest type; factory rebuilt, with new engine guarantee ..... $850

**KINNER R-5**—160 H.P. Few total hours—like new ..... 850

**KINNER K-5**—100 H.P. Front exhaust. Same as new ..... 650

**KINNER C-5**—210 H.P. Under 400 total hours; majored and modified. 450

***Following Engines in "As Is" Condition All average under 500 total hours:***

| No. | Type | Price Each |
|---|---|---|
| 27 | HORNET A-1's—525 H.P. ..... | $500 |
| 18 | HORNET B's—575 H.P. ..... | 850 |
| 25 | WRIGHT R975's—330 H.P. ..... | 675 |
| 40 | CURTISS D-12's—400 H.P. ..... | 500 |
| 18 | CURTISS CONQUERORS — 600 H.P. ..... | 500 |
| 3 | AXELSONS—150 H.P. 7 cylinder, air cooled ..... | 150 |
| 1 | CHALLENGER—185 H.P. ..... | 195 |

## SPECIAL

***While They Last!***

**New, genuine Wright J-6 Exhaust Valves, each.. $12.50**
**J-5 Exhaust Valve Guides, standards, each.... 1.50**
**J-5 Exhaust Valve Guides, plus tens, each.... 3.00**

**Merchandise Quoted Subject to Prior Sale.**

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Aeroncas, Bellancas, Boeing, Curtiss-Wright, Eaglerocks, Fairchilds, Fleets, Fleetsters, Fords, Lockheeds, Northrops, Pitcairn, Stearmans, Stinsons, Travel Airs, Wacos and others.

***Engine parts—new and used—for Wasp and Wright engines at big discounts. Write for bulletin on bargains.***

CHARLES H. BABB · GRAND CENTRAL AIR TERMINAL · GLENDALE, CALIFORNIA

and 21 St., Birmingham, Ala.; 1433 E. 12 St., Cleveland; 2035 Santa Fe Av., Los Angeles; 401 N. Broad St., Philadelphia; 89 East Av., Rochester, N. Y.; 917 Howard St., San Francisco; 161 Brookline Av., Boston; 226 E. 9 St., Cincinnati; 2836 E. Grand Blvd., Detroit; 111 Broadway, New York; Grant Bldg., Pittsburgh; 710 N. 12 Blvd., St. Louis.
Products:
Jig borers. Centering machines. Die sinkers. Drills. Grinders. Lathes and attachments (12" to 20"). Millers. Profilers. Vertical shapers. Small tools (taps; dies; screw plates; cutters; reamers; punches; drills; taper pins; rachet drills; lathe mandrels; threading tools; knurls and knurl sets; hand chasers; counter-bores, solid, interchangeable; mills; forming tools, flat, circular). Gages (*Hoke* precision blocks; micrometers; cylindrical and thread; trusform snap; camshaft comparator; level; taper; end; spline; star). Keller automatic tool room machines. *Kellerflex* finishers and attachments.

**John J. Normoyle Co., Moline, Illinois**
Products:
Sheet metal shears.

**Northill Co., Inc., Los Angeles, Calif.**
A. Wilbur, exec. mgr.; Ed. Zuchelli, sales mgr.; J. C. Patterson, production mgr.; John K. Northrop, chief consultant eng.; Edward Heineman, hydraulic eng.
Products:
Crowner machine (*Carter*). Also hydraulic pumps; folding anchors.

**Norton Co., Worcester, Mass.**
Products:
Grinding machines (cylindrical; semi-automatic cylindrical; external surface; special). Power traverse machines.

## O

**The Oilgear Co., Milwaukee, Wisc.**
Products:
Horizontal oilgear broaches.

**Oesterlein Machine Co., 3301 Colerain, Cincinnati, O.**
Products:
Grinders. Milling machines.

**Oliver Instrument Co., Inc., Adrian, Michigan**
E. C. Oliver, pres.
Products:
Die making machines. Grinders (twist drill; face mill; full automatic; tap; universal cutter; precision tool).

**Oliver Machinery Co., Grand Rapids, Michigan**
M. D. Baldwin, pres. & factory mgr.; A. S. Kurkjian, sales mgr.; H. B. Tuthill, plant mgr.; Ralph DeVries, purchasing agent.
Branch offices:
50 Church St., New York; Bank of Commerce Bldg., St. Louis; Sexton Bldg., Minneapolis.
Products:
Saws (circular; jig). Saw benches and tables. Boring machines. Carving machines. Clamps. Glue spreaders. Grinders. Hand planers and jointers. Lathes (pattern makers' 16" to 30"; speed 8" to 12"; wood turning 32" to 96"). Pattern milling machines. Mortisers. Moulders. Pattern show accessories. Planers. Routers. Sanders. Shapers. Tenoners. Trimmers. Vises.

**Tinius Olsen Testing Machine Co., Philadelphia, Pennsylvania**
Products:
Testing machines.

**Onsurd Machine Co., Chicago, Ill.**
Products:
Routers.

**Oster Manufacturing Co., 2057 E. 61st St., Cleveland, O.**
R. B. Tewksbury, pres.; Roger Tewksbury, vice-pres.; A. S. Gould, sec.; L. S. Newman, adv. mgr.
Factory:
12th & Liberty Sts., Philadelphia.
Branch offices:
292 Lafayette St., New York; 111 N. Third St., Philadelphia.
Products:
Hand tools (stocks; dies). Portable threaders. Power machinery (cut-off; bolt; nipple; bucking-up). Welding equipment.

## P

**Pangborn Corp., Hagerstown, Md.**
T. W. Pangborn, pres.; J. C. Pangborn, vice-pres. & treas.; P. J. Potter, vice-pres.; V. F. Stine, 2nd, vice-pres. & sales mgr.; W. A. Rosenberger, chief eng.; G. S. Goodrich, gen. supt. Representatives: L. W. Wagner (Chicago); C. A. Bultman (Detroit); W. F. Jones (New York City); R. M. Trent (Pittsburgh); B. R. Artz (Syracuse); F. E. Wolf (Boston); H. E. Schellhase (Philadelphia); R. E. Donnelly (Cleveland).
Branch offices:
19 Orchard Ter., Arlington, Boston; 510 N. Dearborn St., Chicago; 3028 Meadbrook Blvd., Cleveland; Stephenson Bldg., Detroit; 122 E. 42 St., New York; 438 E. Allen Lane, Philadelphia; Chamber Commerce Bldg., Pittsburgh; Eckel Theatre Bldg., Syracuse, N. Y.
Products:
Cleaning equipment. *Airless Rotoblast* blast cleaning rooms; hose machines; cabinets; attachments and supplies). All-metal cloth screen dust collectors. Exhausters and blowers.

**Passche Airbrush Company, Diversey Parkway, Chicago, Ill.**
H. F. Reck, vice-pres.
Products:
Airfinishing units and accessories. Portable airpainting units and accessories. (*Oct.*)

**The C. F. Pease Co., Chicago, Ill.**
Products:
Blue printing machinery.

**The Peck, Stow & Wilcox Co., Southington, Connecticut**
Mark J. Lacey, pres. & gen. mgr.; W. O. Seifert, sales mgr., machinery div.
Branch offices:
157 Chambers St., New York.
Products:
Shears (power and foot squaring; circular and flangers; slitting; ring and circular). Combination brake and formers. Power forming rolls. Slip roll formers. Bar folders. Power groovers. Deep throat beading machines. Power corrugating or beading machines. Electrical universal combination machines. Presses (twin; gap punch; double crank; inclinable). Power double seaming machines. (*Oct.*)

**Peerless Machine Company, 1615 Racine St., Racine, Wisc.**
Branch offices:
15 Warren St., New York.
Products:
Metal sewing machines (standard & universal). Pipe threading machines.

**Henry Pels & Co., Inc., 90 West St., New York, N. Y.**
Curt L. Martin, pres.
Products:
Shearing and punching machines (power; hand-operated).

**Penn Rivet Corp., Philadelphia, Pa.**
T. M. Searles, pres.
Products:
Riveting machines. Rivets (tubular; split).

**Perkins Machine Co., Warren, Mass.**
Products:
Presses.

**The Pettingell Machine Co., 77 Elm St., Amesbury, Mass.**
Products:
Power hammers. Rotary shears.

**Plomb Tool Co., Los Angeles, Calif.**
E. D. Moore, sales mgr.
Products:
Special tools. Wrenches. Sockets. (*Oct.*)

**H. K. Porter, Inc., Everett, Mass.**
H. W. Porter, pres. & production mgr.; James G. Geddes, vice-pres. chg. of sales.
Products:
Bolt clippers. Cutters (chain; shear; bench; storage; battery; wire). Nut splitters. Cutting tools. Airplane strand cutters.

(*Continued on following page*)

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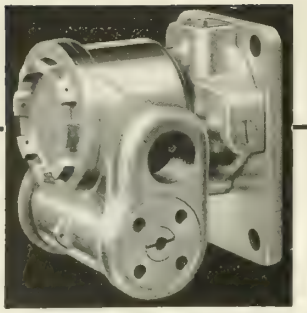
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(*Continued from preceding page*)

**C. O. Porter Machinery Co., Grand Rapids, Michigan**
C. Oscar Porter, pres.; Clare O. Porter, vice-pres. & treas.; John V. Cederlund, supt.; B. E. Porter, eng.
Products:
Wood working machinery (planers; facers; jointers; routers; shapers; cut off saws; lathes; band saws; sanders). Cutter grinders.

**Porter-Cable Machine Co., 708 N. Salina St., Syracuse, N. Y.**
Products:
Disc sanders.

**Potter & Johnston Machine Co., Pawtucket, Rhode Island**
Products:
Lathes (automatic). Screw machines. Universal shaping machines. Automatic chucking and turning machines.

**Thomas Prosser & Son, 15 Gold St., New York, N. Y.**
Branch offices:
7310 Woodward Ave., Detroit.
Products:
Carbide cemented tools. Special grinders. Silicon carbide and diamond wheels. Wear resisting material.

**Providence Engineering Works, Inc., Providence, Rhode Island**
Wm. A. Drewett, pres. & treas.; R. H. Dunbar, vice-pres.; M. G. Jackson, secy.
Products:
Precision high-speed single- and multiple-spindle drilling machines (bench; floor).

## Q

**The Quickwork Co., St. Marys, O.**
Products:
Hammers (power; bumping). Rotary shears. Hydraulic presses.

## R

**Racine Tool & Machine Co., 1774 State St., Racine, Wisc.**
M. E. Erskine, pres.; F. H. Kind, vice-pres. & engr.
Products:
Metal cutting machines. Saws (power hack; metal cutting band). Variable volume hydraulic pumps.

**Reed-Prentice Corporation, Worcester, Massachusetts**
R. L. Thompson, pres.; F. W. McIntyre, vice-pres.
Branch offices:
125 Barclay St., New York.
Products:
Lathes (precision; heavy duty; 14" to 20"). Routers. Vertical milling machines. Die sinking and die casting machines. Timber sawing machines (portable). Rotary and other attachments. Plastic injection moulding machines. Jig boring machines.

**Reliance Machine Sales Co., Pittsburgh, Pennsylvania**
Products:
Sensitive bench drills.

**Rickers-Shafer Co., Erie, Pa.**
Products:
Thread chasers. Tapping machines.

**Rivett Lathe & Grinder, Inc., Brighton, Boston, Mass.**
T. S. Ross, pres.; F. C. Blanchard, vice-pres.; A. B. Hunt, treas.
Products:
Lathes (bench). Grinders (precision; internal and external). Collets. *Pulsolator* automatic oil lubrication systems for industrial equipment.

**Robbins & Myers, Inc., 1345 Lagonda Ave., Springfield, O.**
C. H. Clark, gen. sales mgr.
Products:
Cranes and hoists (electric; hand). (*Oct.*)

**W. Robertson Mach. & Factory Co., Buffalo, New York**
Products:
Power saws.

**Rogers Products Co., Inc., 198 Pacific Ave., Jersey City, N. J.**
Chas. L. Zabriskie, pres. & sec.; Charles P. Rogers, treas.; Curtiss Main, adv. & gen. sales mgr.; Herman Albertine, vice-pres. & chief eng.
Products:
Hydraulic jacks.

**Stanley P. Rockwell Co., Hartford, Conn.**
Products:
Rockwell hardness tester.

**The Rowbottom Machine Co., Waterbury, Connecticut**
Products:
Polishing and buffing machines.

**Joseph T. Ryerson & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.**
Branch offices:
Exchange Bldg., Kansas City, Mo.; Manufacturers' National Bank Bldg., Rockford; 605 Washington Av., N., Minneapolis; 2035 E. 11 St., Tulsa; State Bank Bldg., Rock Island, Ill.
Products:
Drilling machines (heavy duty).

**St. John X-Ray Service, Inc., Long Island City, N. Y.**
Herbert R. Isenburger, pres.; Dr. Ancel St. John, vice-pres. & chief eng.
Products:
X-ray apparatus (portable).

## S

**W. J. Savage Company, Inc., Knoxville, Tennessee**
J. H. Murrian, pres.; J. A. Murrian, vice-pres. & gen. mgr.
Products:
Nibbling machines (nibbler; roller die, 9" to 36" throat).

**George Scherr Company, 128 Lafayette St., New York, N. Y.**
Products:
*Parkson* gear testing jigs. Hobbers (*Reinecker* full universal gear and pinion; high power). Grinding machines (*Reinecker* worm; universal tool). *Reinecker* tooth chamfering machines. *Reinecker* universal relieving lathes. *Zeiss* industrial measuring instruments (optimeter; circular division tester; optical dividing head; camshaft tester; toolmakers' microscope; universal measuring microscope).

**Scintilla Magneto Co., Sidney, N. Y.**
Vincent Bendix, pres.; H. Hanni, vice-pres. & gen. mgr.; T. Z. Fagan, vice-pres. in charge of sales; W. J. Spengler, chief eng.
Branch office:
230 Park Av., New York.
Products:
Magneto tools. Magneto testing stands. Magneto chargers. (*A. Ju.*)

**Scully-Jones, Chicago, Ill.**
Products:
Counterbores (spotfacers and backspotfacers).

**The Sebastian Lathe Company Cincinnati, Ohio**
Products:
Lathes. Tools.

**Seneca Falls Machine Co., Seneca Falls, New York**
M. A. Coolidge, pres. & treas.; E. R. Smith, vice-pres. & gen. mgr.; V. A. Root, sales mgr.
Products:
Lathes (*Low-swing* automatic 4" to 8"; high speed; unit lathe; short cut attachments). Automatic work handling equipment.

**Sharples Specialty Company, Philadelphia, Pennsylvania**
Products:
Centrifugal oil purifier and reclaimer.

**Sibley Machine & Foundry Corp., South Bend, Indiana**
Products:
Drilling machines (upright). Attachments.

**Siewek Tool Co., Detroit, Mich.**
Products:
Standard drill fixtures.

**Singer Sewing Machine Co., Singer Bldg., New York, N. Y.**
Products:
Sewing machines.

**Skilsaw, Inc., Chicago, Ill.**
E. W. Ristau, sales mgr.
Branch offices:
210 E. 40 St., New York; 312 Omar

Av., Los Angeles.
Products:
Portable electric tools (saws; sanders; drills; grinders; hole saws; electric blowers and suction cleaners). Sliding radial arms for saws. Drill stands. Bench and pedestal grinders. Combination grinder-buffers. Electrical accessories. Attachments.

**Skinner Chuck Co., New Britain, Conn.**
Products:
Chucks.

**J. T. Slocomb Company, Providence, Rhode Island**
Products:
Counterborers.

**H. B. Smith Machine Co., Smithville, New Jersey**
E. J. Smith, pres.; A. H. Howe, vice-pres.
Products:
Woodworking machines. Sanders (double and triple-drum endless bed).

**The Smith & Mills Co., Cincinnati, Ohio**
Products:
Shapers.

**Smith Welding Equipment Corp., Minneapolis, Minnesota**
Products:
Welding apparatus. (*Oct.*)

**J. E. Snyder & Son, Worcester, Massachusetts**
Products:
Drill presses.

**South Bend Lathe Works, South Bend, Indiana**
Products:
Engine lathes.

**Southern Iron & Equipment Co., Atlanta, Georgia**
Products:
Wash tanks.

**Speedway Manufacturing Co., 184 S. 52nd Ave., Cicero, Ill.**
G. L. Newcomb, sales mgr.
Products:
Portable tools. Small motors. (*Oct.*)

**The Springfield Machine Co., Springfield, Ohio**
Products:
Engine lathes.

**Standard Electrical Tool Co., 1938 W. 8 St., Cincinnati, O.**
H. V. Feltes, pres. & treas.; L. A. Hauck, vice-pres. & eng.; R. A. Huhn, secy.
Branch offices:
125 Church St, New York; 12 Pearl St., Boston; 341 Frankfort Av., N. W., Cleveland; 2832 E. Grand Blvd., Detroit; 2044 N. 63 St., Philadelphia; 320 Market St., San Francisco.
Products:
Electric drills (portable; radial). Post drill stands. Grinders (tool, post or center; angle plate, internal and external; parallel, vertical angle plate; combination bench and aerial; surface and tool; pedestal; overhand; high speed snagging). Exhauster equipment with air filtering stand. Combination grinders and buffers. Buffers and polishers. Adjustable speed buffing and polishing lathes. Portable electric blowers. Hole saws. Attachments.

**Standard Tool & Mfg. Co., Arlington, New Jersey**
Products:
Reamers.

**Stanley Electric Tool Division, (The Stanley Works), New Britain, Conn.**
H. W. Blackman, sales mgr.
Factory:
New Britain, Conn.
Branch offices:
100 Lafayette St., New York; 61 W. Kinzie St., Chicago; 13 S. Letitia St., Philadelphia; Cleveland; Kansas City, Mo.; Detroit; Los Angeles; San Francisco; Montreal, Que., Canada.
Products:
Drills. Grinders (bench; portable). Tools. Unishears.

**Stark Tool Co., Waltham, Mass.**
Products:
Bench lathes.

**The L. S. Starrett Company, Athol, Massachusetts**
F. A. Ball, pres.; D. Findlay, vice-pres. & gen. sales mgr.
Products:
Mechanics precision tools. Hack saws. Taps. Dial indicators.

**Stedfast & Roulston, Inc., Boston, Mass.**
Products:
Hand operated arbor presses.

**Sterling Products Company, 314 Curtis Bldg., Detroit, Mich.**
Dr. S. James Herman, pres.; Norman B. Herman, vice-pres.; C. T. Ronan, sales promotion; F. D. Nunemaker, adv. mgr.; F. D. Pease, eng.; J. Calvin, asst. engineer; Ottmar Kehle, consulting eng. & production mgr.; R. A. Lundquist, sales mgr., automotive division.
Branch offices:
129 W. Third St., Los Angeles.
Products:
*Speed-Bloc* sander (electric; air-driven).

**Stevens Walden, Inc., Worcester, Massachusetts**
H. W. Bleckley, pres. & gen. mgr.; W. H. Lee, sales mgr.; H. P. Adams, vice-pres. & treas.
Products:
Wrenches. Tools, Mechanics' steel boxes.

**N. A. Strand & Company, 5001 N. Lincoln St., Chicago, Ill.**
N. A. Strand; O. V. Strand; C. W. Blakeslee, sales mgr.
Products:
Portable flexible shaft tools (grinders; buffers; polishers; sanders; drills; reamers; rotary files; wire brushes; screw drivers; nut setters; raspers).

**Strong, Carlisle & Hammond, 1400 W. Third St., Cleveland, O.**
Products:
Electric furnaces.

**Sumner Iron Works, 2411 First St., S., Everett, Wash.**
Products:
Swing saws.

**Sundstrand Machine Tool Co., Rockford, Illinois**
T. B. Buell, sales mgr.
Products:
Lathes (stub). Grinders (tool). Centering machines. Balancing tools. Special machines.

**Surface Combustion Corp., Toledo, Ohio**
Branch offices:
In all principal cities.
Products:
Heat treating furnaces.

**F. J. Swaine Co., St. Louis, Mo.**
Products:
Punch presses.

## T

**The Taft Peirce Mfg. Co., Woonsocket, Rhode Island**
F. S. Blackall, Jr., pres. & treas.; J. W. Wheeler, Jr., vice-pres.; W. A. Gordon, III, sec.
Branch offices:
Woolworth Bldg., New York; 564 W. Randolph St., Chicago; 2921 E. Grand Blvd., Detroit; 167 E. 11 St., Indianapolis.
Products:
Production and service tools. Propeller checking plates. Propeller balancing ways. Propeller protractors and adapters (splined; tapered). Production parts. Contract manufacturing.

**The Taylor & Fenn Co., Hartford, Connecticut**
Products:
Presses. Grinders (water; wet tool). Milling machines. Attachments.

**Thomson-Gibb Electric Welding Co., Lynn, Massachusetts**
District mgrs.: R. S. Donald (New York); I. C. Brown (Clevelanad); R. B. Strout (Chicago); A. E. Hacket (Detroit).

(*Continued on following page*)




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*(Continued from preceding page)*

**Factories:**
Lynn, Mass.; Bay City, Mich.
**Branch offices:**
50 Church St., New York; 10465 Carnegie Av., Cleveland; 205 W. Wacker Dr., Chicago; 4-120 Gen. Motors Bldg., Detroit.
**Products:**
Welders [spot light and heavy duty; aluminum; power automatic], welders [flash; electric resistance; portable gun; seam]. Welding presses. *Weld-O-Meters.* Special equipment designed and constructed.

**Taylor Instrument Co., Rochester, New York**
H. J. Winn, pres. & treas.; W. H. Kimmel, sec.; P. R. Jameson, director of sales; F. K. Taylor and W. M. Griffith, sales mgrs.
**Products:**
Regulating equipment. Anodic tanks. (*Oct.*)

**Thurston Mfg. Co., Providence, R. I.**
Howard C. Arnold, sales mgr.
**Products:**
*Thurco* milling cutters (angular; helical; involute gear; plain milling; *Woodruff* keyseat). Die milling machines and die sinking attachments. Discs. End mills. Saws. Double end mills and chucks.

**Titan Tool Co., Erie, Pa.**
**Products:**
Stud drivers and setters.

**Toledo General Manufacturing Co., 3620 Summit Ave., Toledo, O.**
**Products:**
Drilling machines (*Demco* hand feed; full automatic, single or multiple units).

**The Toledo Machine & Tool Co., Toledo, Ohio**
Harry H. Pinney, pres.; H. U. Herrick, exec. vice-pres.; Harold F. Smith, secy. & treas.
**Branch offices:**
549 W. Washington Blvd., Chicago; 258 General Motors Bldg., Detroit.
**Products:**
Presses (sheet metal working).

**Toledo Scale Co., Toledo, O.**
M. E. Holmes, mgr. industrial scale sales.
**Branch offices:**
In 181 principal cities in U. S. and Canada.
**Products:**
Gauges and testing apparatus (piston ring and valve spring; connecting rod classifying and standardizing; spring testing). *Propeller Blade Balancing Auto Gauge.* Scales.

**Torchweld Equipment Co., 1035 W. Lake St., Chicago, Ill.**
C. K. Anderson, pres.; J. C. Kirchner, vice-pres.; J. L. Jensen, secy.-treas.
**Products:**
Oxy-acetylene non-flash welding and cutting equipment.

**Towsley Machine Co., Cincinnati, Ohio**
**Products:**
Cut-off saws and motors.

**Harold E. Trent Company, 437 N. 13 St., Philadelphia, Pa.**
Harold E. Trent, pres.
**Products:**
Enamel baking furnaces.

**W. W. & C. F. Tucker, Inc., 628 Capitol Av., Hartford, Conn.**
H. B. Tucker, pres.; W. H. Tucker, mgr.
**Products:**
Oil hole covers and cups.

## U

**The Udylite Co., Detroit, Mich.**
A. E. Baldwin, pres.; L. K. Lindahl, vice-pres. & gen. mgr.; C. H. Reeme, treas.
**Products:**
Cadmium plating equipment.

**Union Special Machine Co., 400 N. Franklin St., Chicago, Ill.**
A. M. Sheldon, pres.; Richard MacKay, Jr., vice-pres.; T. S. Whitsel, gen. sales mgr.
**Branch offices:**
210 Lincoln St., Boston; 65 Bleecker St., New York; 49 Cherry St., Johnson City, N. Y.; 22 4 St., Waterford, N. Y.; 401 N. Broad St., Philadelphia; Temple Bar Bldg., Cincinnati; 308 Marion Bldg., Cleveland; 155 Spring St., Atlanta; 1127 Pine St., St. Louis; 5014 College Ave., Kansas City, Mo.; F. W. Braun Bldg., Los Angeles; 682 Mission St., San Francisco.
**Products:**
Sewing machines.

**Union Twist Drill Co., Athol, Massachusetts**
**Products:**
Form milling cutters. Hobbers (thread-milling; special). Reamers. Core drills.

**United States Drill Head Co., 1954 W. Sixth St., Cincinnati, O.**
**Products:**
Drill heads (multiple; fixed; adjustable).

**The United States Elec. Tool Co., 2488 W. Sixth St., Cincinnati, O.**
J. A. Smith, pres.; J. C. Smith, vice-pres.; G. E. Smith, treas.; C. D. Hogan, secy.; G. E. Smith, purchasing agent & sales mgr.
**Branch offices:**
Atlanta; Chicago; Cleveland; Dallas; Denver; Detroit; Boston; Minneapolis; New York; Philadelphia; Pittsburgh; St. Louis; San Francisco; Seattle.
**Products:**
Portable electric tools (drills; valve refacers; sanders; grinders).(*Oct.*)

**U. S. Machinery Company, 136 Liberty St., New York, N. Y.**
**Products:**
Drills.

**U. S. Standard Mfg. Co., Columbiana, Ohio**
**Products:**
Hand milling machines.

**U. S. Tool Co., Inc., Ampere, N. J.**
**Products:**
Die sets. Automatic press feeds. Stock reels. *U. S.* multi-slides (high speed metal forming and stamping). *U. S.* multi-milling machines (dual purpose for hand and production milling).

**Universal Boring Machine Co., Hudson, Massachusetts**
**Products:**
Boring machines.

## V

**Valley Electric Company, S. Kingshighway, St. Louis, Mo.**
**Products:**
Grinders. Buffers. (*Oct.*)

**The V & O Press Co., Hudson, N. Y.**
T. I. Shriver, pres.; Herman Osswald, vice-pres.; Herman F. Zorn, vice-pres. & sales mgr.
**Products:**
Power presses (automatic feed). Special equipment.

**Van Dorn Electrical Tool Co., Towson, Maryland**
R. D. Black, sales mgr.; J. F. Apsey, Jr., adv. mgr.; F. H. Schell, sales.
**Branch offices:**
319 Spring St., N. W., Atlanta; 48 Brookline Av., Boston; 31 Barker St., Buffalo; 2009 S. Michigan Av., Chicago; 2028 E. 22 St., Cleveland; 213 Henry St., Dallas; 708 18 St., Denver; 2818 E. Grand Blvd., Detroit; 2008 Grand Av., Kansas City, Mo.; 1421 S. Flower St., Los Angeles; 1012 Marquette Ave., Minneapolis; 155 Sixth Ave., New York; 545 E. 10 St., Oakland; 710 N. 16 St., Philadelphia; 2822 Locust St., St. Louis; 6030 Broad St., Pittsburgh; 349 Ninth St., San Francisco.
**Products:**
Portable electric tools (drills; torsimeters; sanders; valve seat grinders; valve refacers).

**Van Norman Machine Tool Co., Springfield, Massachusetts**
L. F. Hunderup, sales mgr., automotive div.; H. G. Hoglund, sales mgr., machine tool div.
**Products:**
Boring bars. Valve seat grinders and cutters. Valve seat ring tools. Valve refacers. Stud pullers. Automatic piston turning and grinding machines. Milling machines (tool room; production; universal).

## W

**Wadell Engineering Co., Newark, N. J.**
Products:
Boring fixtures.

**Walker-Turner Co., Inc., Plainfield, New Jersey**
John L. Hasemann, mgr. industrial flexible shaft div.
Products:
Lathes (woodworking; gap bed; metal working). Saws (jig; bench; band; tilting arbor). Drill presses. Vertical spindle shapers. Flexible shafts and attachments. Motor grinders. Motors and attachments. Transmission equipment and attachments. Benches and machine stands.

**J. D. Wallace & Company, S. California Ave., Chicago, Ill.**
Products:
Saws (circular trim; portable band; band; universal saw bench union). Jointers.

**The Warner & Swasey Co., Cleveland, Ohio**
P. E. Bliss, pres.; Chas. J. Stilwell, Clifford S. Stilwell, vice-presidents.
Branch offices:
Iroquis Bldg., Buffalo; 238 Main St., Cambridge; 618 Washington Blvd., Chicago; Mutual Home Bldg., Dayton; Maccabees Bldg., Detroit; 409 Velasco St., Houston; 1118 Santa Fe Av., Los Angeles; Wells Bldg., Milwaukee; Amer. Insurance Bldg., Newark; 6910 Market St., Upper Darby, Philadelphia; Chamber of Commerce Bldg., Pittsburgh; 108 Grant Av., Syracuse.
Products:
Lathes (turret 12" to 34"; universal; heavy duty; adjustments). Screw machines.

**Waterbury Farrell Fndry. & Mach. Co., Waterbury, Connecticut**
Branch offices:
Bulkley Bldg., Cleveland; Daily News Bldg., Chicago; Military Park Bldg., Newark.
Products:
Rivets, bolts, screws and nut machinery (single and multiple stroke open and solid die). Cutting up machinery (arch geared drawing presses; hydraulic embossing presses; knuckle joining presses; collapsible tube machinery; sub press pillar presses). Presses (open back single-action; double-action; pillar type single-action). Lathes (automatic; semi-automatic; trimmers; hand trimming and knurling; hand feed and semi-automatic; screw cap threaders). Mill machinery. Shears. Rolling mills. Wire roll and drawing machinery. Forming machines.

**Watson-Stillman Company, 72 West St., New York, N. Y.**
Products:
Forcing presses.

**Weaver Manufacturing Co., S. Ninth St., Springfield, Ill.**
Products:
Presses.

**Wellman, Saver & Morgan Co., Cleveland, Ohio**
Products:
Hydraulic presses.

**Western Tool & Mfg. Co., Springfield, Ohio**
Products:
Mandrels.

**Westinghouse Electric & Mfg. Co., East Pittsburgh, Pennsylvania**
Factories:
East Pittsburgh; Attica, N. Y.; Chicopee Falls, Mass.; Cleveland; Derry, Pa.; E. Springfield, Mass.; Emeryville, Calif.; Mansfield, O.; Newark; Pittsburgh; St. Louis; Sharon and South Philadelphia, Pa.; Lima, O.
Branch offices:
Phoenix; Los Angeles; Oakland; San Francisco; New Haven; Wilmington; Washington, D. C.; Jacksonville; Tampa; Atlanta; Chicago; Peoria; Evansville; Indianapolis, Ind.; Des Moines; Sioux City; Waterloo, Ia.; Wichita; Augusta, Bangor, Me.; Baltimore; Boston, Springfield, Worcester, Mass.; Flint, Detroit, Grand Rapids, Mich.; Duluth, Minneapolis, St. Paul, Minn.; St. Louis; Butte, Mont.; Omaha; Newark; Trenton; Albany, Binghamton, New York, Rochester, Syracuse, Utica, N. Y.; Charlotte, Raleigh, N. C.; Cleveland; Toledo; Oklahoma City; Tulsa; Portland, Ore.; Allentown, Philadelphia, Reading, York, Pa.; Providence; Columbia, Greenville, S. C.; Memphis; Burlington; Richmond; Dallas; Ft. Worth; Houston; San Antonio; Seattle; Spokane; Madison, Wisc.
Products:
Air conditioning apparatus. Electric melting pots. *Ignition* spot welding timer. Arc welding sets. Battery charging units. Motor generator sets for anodic treatments. (*A; Ju Oct.*)

**Wetmore Reamer Co., 418 N. 27 St., Milwaukee, Wisc.**
Chas. G. Forster, pres.; Edward D. Johnson, treas.; Carl A. Forster, secy.
Products:
Reamers (adjustable). Special tools.

**Baxter D. Whitney & Son, Inc., Winchendon, Massachusetts**
Products:
Variety rip saws. Spindle shapers. Surfacers.

**W. A. Whitney Mfg. Co., 636 Race St., Rockford, Ill.**
H. C. Spengler, pres.
Products:
Portable and bench lever punches.

**Wickes Bros., Saginaw, Mich.**
C. Bintz, sales mgr.
Products:
Crankshaft turning equipment (heavy duty lathes 20" to 34"; production lathes). Gang saws. Electric blueprinting machinery. Special machinery.

**Wiedemann Machine Co., Sedgley Ave., Philadelphia, Pa.**
Theodore Wiedemann, pres.; T. A. Wiedemann, sales mgr.; E. J. Rollings, supt.
Products:
Turret punches.

**Wilson Welder & Metals Co., Inc., North Bergen, New Jersey**
T. B. Hasler, pres.; S. S. Stewart, production mgr.; C. S. Osborne, chief eng.
Products:
Welding machines (electric arc). Electrodes (aluminum rod; stainless steel rod).

**Winter Bros., Detroit, Mich.**
Products:
Taps.

**Worthington Pump & Machine Corp., Harrison, New Jersey**
Products:
Core wire machines. Compressors (air; gas). Pumps. V-belt drives. Meters (water; oil; grease).

**Wrought Washer Mfg. Co., Milwaukee, Wisconsin**
F. C. Doepke, pres.; C. H. Disch, vice-pres.; W. F. Disch, sec.-treas.; E. Caldwell, gen. mgr.
Products:
Washers. Stampings. Expansion plugs. Tools and dies. Special machinery. Riveting washers (riveting burrs).

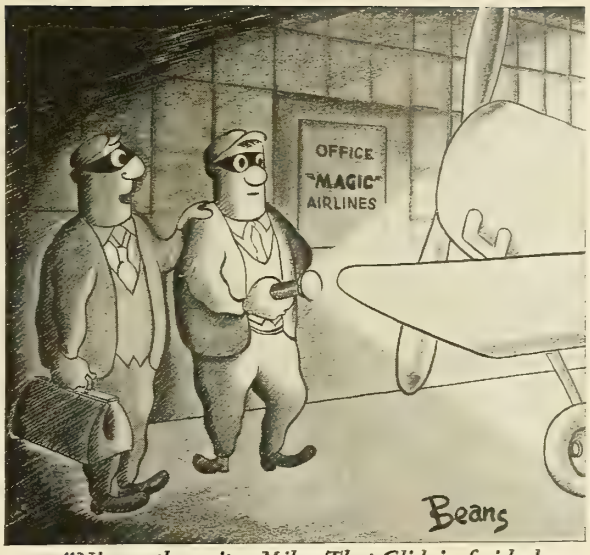
## Y

**Yale & Towne Mfg. Co., (Phila. Division), 4530 Tacony St., Philadelphia, Pa.**
Products:
Electric chain hoists (spur geared; screw geared; differential; *Pul-Lift*). Hand lift trucks. Skid platforms. *Yale* electric industrial trucks. (*Oct.*)

**Yates-American Machine Co., Beloit, Wisconsin**
Branch offices:
Rochester, N. Y.
Products:
Saws (combination band, rip and resaw; cut-off; band). Motor-driven hand jointer.

**Yoder Company, Cleveland, O.**
Products:
Hammers (pedestal).

**Young Bros. Co., Detroit, Mich.**
Products:
Ovens (heat treating, finishing, etc.).


*"Nix on the swipe, Mike. That Glidair-finished plane looks swell—but where would we stow it?"*

The Glidden Company offers to the aircraft industry a new line of PIGMENTED NITRATE DOPES. HIGHER LUSTRE—CLEANER COLORS—INCREASED FLEXIBILITY—EASIER POLISHING—EXCELLENT WEATHERING QUALITIES—***Write for free color card.*** Before re-covering your ship, investigate GLIDDEN FABRICOTE—***Write for free booklet.***

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He must possess—or have access to—a design for a light, low priced plane capable of competing with current popular makes now on the market.

No investment is required, unless it is his wish to make one. Our primary concern is to contact exactly the right man to fill this important post. To that man we will give—in addition to a salary—an interest in the company proportionate to the energy, ability, background and loyalty he puts into the task assigned him.

Only those with a well-rounded manufacturing experience—plus *workable* ideas—need to write. *No other applications will be considered.*

In reply, please give complete educational, business and aircraft manufacturing background, references and whatever other data you believe will be helpful in determining whether or not you are the man for the job.

**AERO DIGEST, BOX 2480**
**515 Madison Ave., New York, N. Y.**

# DIGEST OF THE NEWS

## AIR SERVICES

### More Planes, Engines

Additional order for 28 PT-13A Lycoming-powered primary training planes has been awarded to Stearman Aircraft Co. by the War Department. Total cost of the contract was $146,720 which includes spare parts. Expansion of the original award was made to effect savings in cost.

* * *

Award of a $2,743,721 contract for 249 engines to the Pratt & Whitney Division of United Aircraft Corp. was announced by the Navy Department.

* * *

Delivery of three low-wing *Electra* transports to the U. S. Army Air Corps was begun in December by Lockheed Aircraft Corp. These planes are being used for transportation of personnel by the Air Corps staff.

* * *

From April to Dec. 1, Randolph Field received 69 new training planes of which 19 were BT-8s (Seversky); 28 BT-9s (North American); and 22 PT-13s (Stearman). All are used in connection with student training.

### Awards

The Henry S. Wellcome gold medal and $500 cash prize was awarded to Capt. Harry G. Armstrong, medical officer in charge of the Physiological Research Laboratory, Wright Field and author of several articles which appeared in AERO DIGEST recently. The award was based on Capt. Armstrong's paper *The Importance of Coordinating the Military and Naval Medical Services with the Civilian Medical Profession* which will be published in the *Military Surgeon*.

* * *

The Distinguished Flying Cross has been awarded to three Air Corps officers and two Air Corps enlisted men. Brig. Gen. H. H. Arnold heads the list of recipients for his Alaskan Flight of 1934. The others are Maj. B. M. Giles, Second Lieut. J. H. Patrick, Jr., Staff Sergeant D. E. Hamilton and Corporal F. B. Conner, all of whom participated in a mission of mercy which was instrumental in saving the lives of seven men.

### New O-47 Plane

Receipt of a contract for 120 observation planes by North American Aviation, Inc., focused attention on one of the newest Air Corps types. Designated O-47, the new North American observation plane is a mid-wing all-metal monoplane designed specifically with the requirements of the observer in mind.

The plane carries a crew consisting of pilot, gunner and observer. It is large and roomy, providing ample space for photographic work, mapping and general observation. The observer also has an upper position for radio or acting as relief pilot. The gunner is in the rear, and the pilot forward with good visibility in all directions.

Structural rigidity and simplicity have been maintained throughout. Features which contribute to exceptional performance include a completely retractable landing gear and tail wheel, shape of the cockpit enclosure, the engine cowling, a particularly clean tail group and the streamlined fuselage. Power is supplied by a 1000 hp Wright Cyclone.

Actual production on this contract will begin next summer, the intervening time being taken up by engineering, tooling, testing and Air Corps acceptance tests. Additional personnel at North American Aviation will be required in the spring.

## AIRPORTS

### Improvements

Battle Creek, Mich., Kellogg Airport. Elimination of runway slopes; removal of trees bordering field.

Buffalo, N. Y., municipal airport. Administration building; two hangars; macadamizing runways; grading of water shed and north area; extension of boundary lights; $1,340,000.

Cambridge, Ohio, municipal airport. Enlargement by three to four acres; extension of runways.

Little Rock, Ark., municipal airport. New $3500-ft. concrete runway; additional hangars; plans for $20,000 depot and café.

Sherman, Tex., municipal airport. Two runways—2500 ft. × 100 ft. extending E-W; 1500 ft.





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ST. PETERSBURG, FLORIDA

*"The Sunshine City"*

× 100 ft. extending NE-SW. $35,312 WPA; $13,165 city appropriation.

Spokane, Wash., Felts Field. Five-plane hangar for Northwest Airlines, Inc. Joint WPA-Northwest Airlines project.

* * *

Washington, D. C., Washington-Hoover Field. Installation of two-way radio system.

### Personnel Notes

Roosevelt Field, Inc., reports the resignation of its president George W. Orr who, after 10 years in aviation, decided to accept an executive position with a large chemical organization. Jim Guthrie, long associated with Roosevelt Field activities, has been chosen to fill Orr's position.

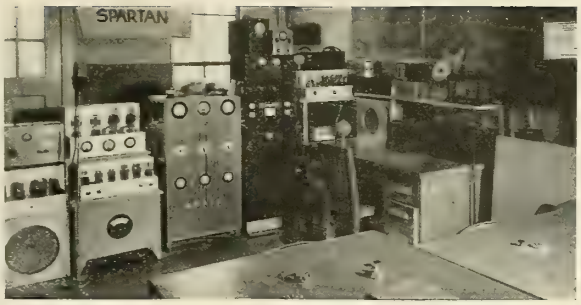
* * *

Keith R. Moon has replaced E. A. Goff, Jr. as manager of the Kellogg Airport, Battle Creek, Mich.

## SCHOOLS

### Student Activities

A 900-watt telephone transmitter and a 135-watt telephone and code transmitter were built by Spartan School of Aeronautics' students as part of their practical work. Operation is conducted by qualified students, and by a special instrument developed in the school radio laboratories, a ground course is given in flying the radio range beacon system and in solving navigation problems by radio.




*Radio department at Spartan School of Aeronautics showing apparatus used in instructing students*

* * *

Students in the Metals Division, Boeing School of Aeronautics, are building a low-wing, all-metal high speed trainer. It is a two-place cabin monoplane designed by instructor John W. Thorpe with the assistance of other members of the Engineering Department.

* * *

Regular election of officers of Parks Air College Aero Club brought the presidency to Paul Taylor. Others elected were Walter Hyatt, vice-president; J. B. Dunleavy, treasurer; and C. J. Hirst, secretary.

### Personnel Notes

United Air Services, Ltd., has engaged Tex Rankin to direct flight training and instruct in aerobatics and blind flying and has added to its fleet of planes a Ryan S-T equipped for inverted flight.

* * *

Named to the newly-formed technical committee of the Rising Sun Aircraft School, Inc., Philadelphia, are Kern S. Dodge, Richard Bircher, W. Laurence LePage, Alfred L. Wolf and Augustine Pasquarella. President Fred Vilsmeier made the appointments.

### New Courses

Aeronautical Institute of Los Angeles broadened its scope to include courses in aeronautical engineering, drafting, sheet metal fabrication and aircraft mechanics. Personnel has been expanded by three new instructors and training consists of practical as well as theoretical applications. The school is under the management of Theodore A. Woolsey.

* * *

Night classes in airplane and airplane engine mechanics have been opened by Robertson Aviation School, Lambert-St. Louis Municipal Airport. With a total enrollment of 72, it has been necessary to enlarge facilities to provide for anticipated increases in 1937 enrollments.

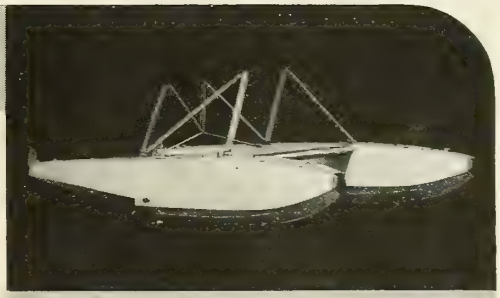
## PRIVATE FLYING

### Personnel Notes

Edwin J. Schwanhausser, president of the Buffalo (N. Y.) Chamber of Commerce, appointed an aeronautics committee consisting of Reginald V. Williams, chairman; Peter D. Allen; Lawrence D. Bell, president of Bell Aircraft, Inc.; Adrian Block; E. Harold Brayer; Merrill J. Campbell, AERO DIGEST representative; Norman P. Clement; William J.

(*Continued on following page*)


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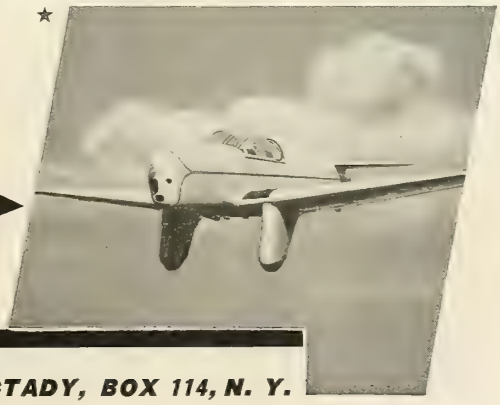
in New York. 1937 will be a seaplane year. Prepare for it by acquainting yourself fully with EDO Float gear—rugged, buoyant, aero-dynamically engineered. At the Show you may inspect at close range these highly developed aids to water-flying.

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**BASIC TRAINER AND SPORT PLANE**

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***BEN JONES, INC.*** ***SCHENECTADY, BOX 114, N. Y.***

(*Continued from preceding page*)
Connors, Jr.; Franklin D. Davis; J. Allen Gardiner; William T. Jebb, Jr.; Theodore C. Knight; George S. Lapp; George Waite; and Ray P. Whitman, also of Bell Aircraft.

* * *

At the regular meeting of the South Bend Pilots Club, South Bend, Ind., officers elected for 1937 included Harry S. Wagner, president; Fred T. Wharton, vice-president; Marjorie Stables, secretary; Louis Taylor, treasurer; and George Fetters, sergeant-at-arms. The Board of Directors consists of Homer Stockert, Raymond Van De Viere, Charles Schrader, Vern Rutherford and Glenn Trickel.

### Texas Tour

Led by William McCraw, Attorney-General of the State of Texas, seventeen planes made a 1250-mile aerial tour of Texas, starting from and ending at Love Field. Thirty-five people were aboard the planes which visited Beaumont, Galveston, Corpus Christi, Brownsville, San Antonio and Austin, as well as numerous small towns along the route. Bub Merrill was flight marshal, and along the route as many as 25 planes were in the flight, several joining at South Texas points for short hops.

### Miami Races

The ninth annual All-American Air Maneuvers ended Dec. 12 at the Miami Municipal Airport with the running of the Green Trophy and Glenn H. Curtiss Trophy events which were among the featured contests.

Both events were won by Bill Ong, whose times of 173.872 and 194.689 mph gave him the Green and Curtiss trophies, respectively, and $1200 in cash prizes.

Inclement weather along the seaboard necessitated postponement of the first days races, but on the second day Mike Murphy won the Taylor Cub race at 85.49 mph, the Argentine Trophy went to D. Wallace at 165.13 mph, and Karl Voelter won the Santa Domingo Trophy at 93.65 mph.

Acrobatic demonstrations were given by Alex Papana of Rumania, Lieut. Joseph Mackey, Len Povey of Cuba and Harold Johnson.

Leading money winners during the three days, in addition to Ong, were D. Wallace, $550; R. Glass, $500; and L. Doyle, $450.

Climax of the maneuvers was the Miami-Havana race, a handicap event won by Roy S. Evans in his Monocoupe. Second place went to Larry Schmidlap who flew a Waco, and third place was won by P. S. Sones in a Stinson.

# Coming Events

"Aviation in Industry" Exhibition; International Building, Rockefeller Center, N. Y., N. Y., sponsored by AERO DIGEST. Dec. 1-Jan. 15.

•

National Aviation Show, auspices Aviators' Post 743, American Legion, Grand Central Palace, New York. Gus Parsons, managing director, Jan. 28-Feb. 6, 1937

•

Second Annual National Pacific Aircraft and Boat Show, Pan-Pacific Auditorium, Los Angeles, Calif. Cliff Henderson, managing director, Mar. 13-21, 1937

•

New York to Paris Race. Sponsored by French Air Ministry, Pierre Cot, Minister of Air. Take-offs permitted from May 21 to (and including) Sept. 15.

•

First Salon International de Aeronautique. Palais du Centaire, Brussels, Belgium. Sponsored by Ministry of Transport and Belgium Aero Club. June 18-30

•

National Air Races. Municipal Airport, Cleveland, Ohio. Cliff Henderson, managing director. Sept. 3-6

## AIRLINES

### Personnel Changes

Announcement of the appointment of W. S. Burton as sales manager of Northwest Airlines, Inc., in Western Montana was made by Croil Hunter, vice-president and general manager of the company.

* * *

Western Air Express has appointed Thomas Wolfe vice-president in charge of traffic and has elected Ralph Waycott of Pasadena to its board of directors. Other changes provide for the appointment of Rufus Lee Carter as district traffic manager in Los Angeles, and of Hugh Coburn as assistant general traffic manager.

* * *

New directors of Transcontinental & Western Air include its operations vice-president Paul E. Richter and Howell Van Gerbig. Richter's appointment brings the number of TWA personnel on the board to three, the others being President Jack Frye and Vice-President F. G. Wilson.

* * *

Sam Lieb of United Air Lines is to be appointed manager of domestic and foreign travel for the company, to handle agents jointly for Western Air Express.

* * *

Department heads and supervisory personnel chosen for its

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traffic and operations department have been announced by C. Bedell Monro, president of recently-formed Pennsylvania-Central Airlines Corp. W. S. Rosenberger is operations manager; assistants are W. R. Manchester in charge of flight operations at Cleveland; Luther Harris, in charge at Detroit; and R. W. Coulter. Chief pilot is R. L. Baker. Traffic heads include J. J. O'Donovan, eastern region; Howard E. Kennedy, western region.

### 842,155 Passengers

Domestic airlines operating in the United States carried 842,155 passengers during the first ten months of the year, or 18,716 less than the number carried all of last year on both domestic and American-owned foreign lines. With reports for November and December still untabulated, it is expected that 1936 air travel will exceed 1,000,000 on domestic lines alone.

These lines set all time highs for the amount of express carried, number of passenger miles, express pound miles and passenger seat miles flown during October. Reports show that 799,266 lbs. of express were carried—an increase of 140,000 over the previous month. Passenger miles totaled 44,411,139; express pound miles 425,456,139 and seat miles 64,542,595. A total of 102,917 passengers flew with the 23 airlines during the month and 5,912,669 miles were flown. Although these latter figures are not records, they represent increases over the previous month and the same month of 1935.

* * *

November was the most active month in the history of Chicago & Southern Air Lines, Inc. Passengers exceeded by 21% those carried in October, the company's previous best month and a new high in cash sales was established, sales increases reaching 293% above November, 1935.

### More Douglases

Second order for 5 additional Douglas *Flagships* has been placed by American Airlines, bringing to 30 the number of this type purchased by this airline alone. Other orders for DC-3 equipment came from Western Air Express for two P & W-powered sleepers and from Eastern Air Lines for five Wright Cyclone-powered 21-passenger day planes.

### New Schedules

First direct route from New York to Houston was inaugurated Dec. 15 by Eastern Air Lines with a through round-trip service daily, on a less than 12-hour schedule.

## Digest of Recent Events

**Condors Set Load Records in Peru**

A new record for transportation of heavy loads at high altitudes was made by a Curtiss Condor plane of the Condor Aviation Co. in a flight from Cuzco, 10,900 ft. above sea level to Huancamba, site of the Cotabambas mines, which is at an elevation of 12,500 ft. Thirteen trips were made in two days, carrying 25 tons of mining equipment as well as passengers. Maximum load carried was 3.5 tons, more than double any previous load ever carried from Cuzco. NOV. 23

**Altitude Mark With Load Credited to Italian Flyer**

A tri-motored flying boat, commanded by Captain Mario Stoppani, set a new world altitude record of 6,727 meters (22,070 ft.), carrying 5,000 kilograms (11,012 pounds) of cargo. The previous record of 6,221 meters (20,405 feet) with 5,000 kilograms was set by Capt. Boris Sergievsky in a Sikorsky. Another record of 7,831 meters (25,686 feet) with 2,000 kilograms (4,404 pounds) was claimed for Captain Stoppani's plane, bettering the previous mark of 7,507 meters (24,623 feet) set by a French plane. DEC. 2

**Mrs. Mowry Establishes New Women's Marks**

Three world records in categories for which no previous feminine mark had been entered were credited to Mrs. Crystal Mowry, of Miami, for flights over Biscayne Bay. She flew a seaplane weighing less than 1,499 pounds, to an altitude record of 7,000 feet, and over a 100-kilometer course at 79.2 miles an hour, then changing into a smaller seaplane, still flying a passenger, she flew over the 100-kilometer course at 66 miles an hour for the third record. DEC. 11

**De Seversky Sets Record Between Miami-Havana**

Alexander P. de Seversky set a speed record for flight in a Seversky amphibion between Miami and Havana, traveling the distance of 220 miles in 1 hour 14 minutes. He thus completed a flight from New York which began the previous day, and in which his elapsed time was seven hours. DEC. 14




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## THE INDUSTRY

### Aircraft Shows

With Jan. 28, opening date of the National Aviation Show drawing near, interest is mounting steadily as additional exhibitors take space and plans for attendance take concrete form.

In addition to the exhibitors listed in the December issue of AERO DIGEST new organizations taking space are: Roosevelt Field, Inc.; Wright Aeronautical Corp.; Cuno Engineering Corp.; Braman-Johnson Flying Service, Inc.; Federal Laboratories, Inc.; L. C. Chase & Co., Inc.; Parks Air College, Inc.; Cleveland Pneumatic Tool Co. Street & Smith (*Air Trails*); Cessna Aircraft Company; *Western Flying;* Snap-on Tools, Inc.; The Pyle-National Co.; Maynard Di Cesare Propeller Corp.; S. Appel & Co.; Chicago Pneumatic Tool Co.; F. W. Kessler; Oldham Multi Tool; Gillies Aviation Corp.; Eastern Airlines; Warner Aircraft Corportion; Kellett Autogiro Corp.; Monocoupe Corporation; Howard Aircraft Corp.; Casey Jones Amphibion; Goodyear Tire & Rubber Co.; Lockheed Aircraft Corp.; McLaughlin Aerial Surveys; U. S. Army; U. S. Navy; Aeronautical Corp. of America; Switlik Parachute & Equipment Co.; Virginia Rubatex Corp.; Rohm & Haas Co.; The Herald Tribune; *Trips.*

### 2197 Planes Produced

Manufacturers in the United States produced 2197 airplanes in the first 9 months of 1936, a 68% increase over the corresponding period of 1935.

Of the airplanes produced during this period 1287 were for domestic civil use. There were 573 for delivery to the military services, and 337 for export.

Among those for domestic civil use, monoplanes led biplanes 1117 to 170. Among airplanes of various sizes the most numerous were two-place closed landplane monoplanes, of which 744 were produced for domestic civil use.

In addition to the 2197 airplanes, American manufacturers in this period produced 23 gliders, one autogiro and 15 lighter-than-air craft.

### New Lights

Type NAW-42 navigation lights, produced by Pyle-National Co., are being installed in all transport planes operated by Eastern Airlines.

The installation is being made at the Miami maintenance base as planes are received for their 100-hour periodic overhaul and check. According to Charles Froesch, chief engineer, these lights, which are completely streamlined into the wings, provide greater visibility and eliminate blind spots.

### Price Reduction

Walter Kidde & Co., Inc., have just announced a price reduction on the Lux Airplane Engine fire extinguisher system. Reductions amount to about 13% for installations on single-engined planes.

The company is expanding its sales department and its aviation sales managers now include C. L. Griffin, New York; S. G. Freck, Chicago; H. B. Teter, Cleveland; A. H. Hobelmann, Washington; and R. V. Morris, San Diego.

### Removals

Larger and more pretentious quarters have been acquired by Suncook Mills at 40 Worth St., New York, N. Y., according to Val Dietz, Jr., aviation sales manager.

* * *

Dow Chemical Co., Midland, Mich., has opened a Chicago office in the Field Building with Wilson I. Doan in charge.

### Business Reports

Capital structure of Beech Aircraft Co. has been readjusted to permit acquisition of factory and site and to increase active working capital. Name of the company has been changed to Beech Aircraft Corp., and stock is expected to be listed on the New York Curb Exchange. Readjustment of capital structure provides Beech with augmented working capital to permit further developments and refinements, including addition of new models and a new twin-engined all-metal low-wing monoplane which will be described in the February issue of AERO DIGEST.

* * *

Reincorporation of Solar Aircraft Company, Ltd., was announced by Edmund T. Price, president. Name has been changed to Solar Aircraft Co., and 300,000 shares of $1 par value stock authorized of which 50,000 are for sale, 20,000 available at this time. Sales of the company have increased and as of November 5, 1936, business stood at $187,518, an increase of 41% over 1935 business for the same period.

### New Companies

Air Tours, Inc., Put-In-Bay, Ohio. Incorporators M. H. Earhart, T. E. Colman, Robert C. Tyler.

Service Aircraft Co., Inc., Long Beach, Calif. Officers Randall Martin, Walter C. Chaffee, Jr., Wm. A. Frye. Manufacture of aircraft.


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***Published in MARCH this year for distribution at the National Pacific Aircraft Show***

## Aircraft in Industry

With sixty companies displaying products, *Aircraft In Industry*, the exhibition sponsored by AERO DIGEST, is daily attracting an average of 200 designers, engineers and technicians to the International Building, Rockefeller Center, N. Y. where the exhibits remain on display until Jan. 15.

Featuring a number of animated displays, the exhibition is outdrawing some of the previous shows held in the Metals & Plastics Gallery. In the list of exhibitors are found Republic Steel Corp., with a 30-ft. display showing various crankshafts, landing gear oleo and shock struts, stainless steel assemblies, cylinder barrels, propeller hubs and tubing. Goodyear Tire & Rubber Co. is exhibiting an assortment of airwheels and brakes while Curtiss Aeroplane & Motor Corp. is displaying a number of finished and unfinished forgings and welded assemblies. The Marblette Corp., manufacturers of plastics, has a number of accessories on display, while another interesting exhibit is a new-type sliding window by Young Windows of Amer.

Other exhibitors and their exhibits are Sherwin-Williams, painted sections, parts and tail surfaces; U. S. Weather Bureau, RCA airport receiver, Frieze anemometer, wind-direction indicator and velocity meter; Bartow Beacons, Inc., revolving airport beacon and 36″ lenses; Sperry Gyroscope Co., 24″ rotating airway beacon, animated display of the gyropilot; B. G. Corp., a 22-ft. airway map of the world, and cut-away spark plugs and materials used in their manufacture; Pure Oil Co., model of Cabin Creek Refineries; Solar Aircraft Corp., exhaust manifold assemblies; L. C. Chase, various upholstery fabrics; B. F. Goodrich Co., animated de-icer, tires and rubber accessories; Climax Molybdenum Corp., forged and welded aircraft and engine parts; Summerill Tubing Co., chrome molybdenum Bellanca engine mount, assorted sizes of square, round and streamlined and extruded tubing; International Nickle and Marlin Rockwell, a combination display featuring various Fleetwings sections and many types of bearings; SKF, moving ball bearing units.

Bendix Wheel & Brake Corp., brakes, brake-installations; Ex-Cell-O Aircraft & Tool Corp., panel of precision instrument parts; Wyman-Gordon, forging of a Wright Cyclone crankshaft with dynamic damper; Fafnir Bearings, case of assorted aircraft bearings; Eclipse Aviation Corp., generators, pumps, valves, starters and de-icer oil pump separators; Wright Aeronautical Corp., a cut-away and animated Cyclone R1820-F-1 engine of 700-hp; Hamilton Standard Propellers, cut-away and complete controllable-pitch propellers, finished and unfinished propeller hub sections; Dardelet Threadlock Corp., display case of self-locking screw threads; Berry Bros., display of oil paintings by William Heazlip; New York World-Telegram, illuminated map showing Ekins' route on his around-the-world flight; Irving Air Chute Co., chair-type parachute; Mt. Vernon Die Casting Corp., instrument cases.

Aerial photographs are displayed by McLaughlin Aerial Surveys, Fairchild Aerial Surveys, Aerial Explorations; Gulf Oil Co. has an illuminated display case with appropriate illustrations; Transcontinental & Western Air, illuminated and animated display of its transcontinental route; Stanley Works, panel display of aircraft hardware; Massachusetts Mohair Plush Co., fabrics, patterns, styles of fabrics; Rohm & Haas, crude and finished forms of *Plexiglass;* Magnaflux Corp., inspection equipment; Weston Electrical Instrument Co., aircraft instruments; United Air Lines, animated display of its routes; Reading Battery Co., cut-away and complete batteries of various sizes; Champion Spark Plug Co., cut-away plugs; Electric Storage Battery Co., Exide type XT battery showing cut-away sections and parts; Western Electric Co., type 20 receiver and type 19 radio transmitter; Thiokol Corp., parts and sections of synthetic rubber; Walter Kidde & Co., Lux fire extinguisher system; Fairchild Aviation Corp., Kruesi radio compass, loop and units; Geo. Ruehfel Co., inclinometer and glass level gauges, turn and bank indicators for aircraft; Eastern Air Lines, full size model of pilots' compartment of Douglas transport, showing arrangement of instruments, radio, and other devices; Cambridge Instrument Co., panel layout showing installation and actuating mechanism of the Aero Mixture Indicator; Johnson & Faulkner, display of fabrics; Elastic Stop Nut Corp., display case of various sizes of nuts, fasteners, etc.; Haskelite Manufacturing Corp., plywood and photographs of planes in which its products are used.

Illustrations of the *Aircraft In Industry* exhibit are shown on the frontispiece of this issue of AERO DIGEST.


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# FOREIGN ACTIVITIES

## 48 Planes, 80 Engines Shown at Paris Exhibition

● More interesting than any of its predecessors, the XV Salon de l'Aviation attracted thousands of persons to the Grand Palais, Paris from November 13 to 29. On display were 48 airplanes, 80 engines and a variety of parts and accessories from seven nations, notable exceptions being Italy and Germany.

Thirty-seven percent of the aircraft exhibited were military types, all indicating remarkable aerodynamic progress since the 1935 show. Two years ago the fastest pursuit on the floor boasted 260 mph; this year four had top speeds of 310 mph or better, six 280 mph or better.

Standardization of French bombers was evident in the twin-engined, all-metal retracting gear monoplanes fashioned somewhat after our transport types. A tendency however was noted toward mid-wing designs with double finned and ruddered cantilever tail surfaces. Nose sections are as yet unstandardized, the visitor perceiving various shapes and types and a decreasing use of the cupola turret.

French pursuit planes feature metal construction, cantilever low wing types predominating. Armament in many cases combines 20 mm. canon and machine guns and cockpits in the newest types are enclosed in transparent canopy tops.



*View of the Grand Palais showing some of the craft displayed*

Largest machine exhibited was the Farman 224, a four-engined semi-cantilever wing monoplane of mixed construction. Capable of carrying 40 passengers and a crew of 5, this plane's Gnome-Rhone engines deliver a total of


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*Engine*—P & W Hornet S5E, 700 h.p. at 2050 r.p.m. at 6000 ft.

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3200 hp and provide a maximum speed of 192 mph. Engines are mounted in tandem. Largest military type exhibited was the Marchel Bloch 131, a twin-engined all-metal monoplane with cantilever wings.

Among exhibits from outside France, the two Dutch stands were most interesting and, presenting the more radical innovations, attracted the greatest attention. The Koolhoven FK-55, a single seater fighter of the mid-wing type was particularly outstanding in that it utilizes tandem-mounted twin propellers which rotate in opposite directions. Driven by a 900 hp Lorraine water-cooled engine located aft of the pilot's cabin on the center of gravity, the plane incorporates differential gears which rotate the propellers, driving torque being taken up by a shaft extending under the cockpit. Plywood covering is utilized in the fuselage; wings are also of wood construction, have a short span and provide wells for flush retraction of the landing gear. Armament consists of 2 canons and 2 machine guns, and maximum speed is said to be about 335 mph.

Fokker showed one of the most formidable military planes on the floor. A two-place fighter-bomber-reconnaissance mid-wing monoplane, this machine, known as the *Mower* and designated G-1, is unorthodox in design. It has two fuselages which are extensions of the engine nacelles and which carry the tail plane and double fins and rudders at its extremities. The full cantilever wing is of wood construction, follows Fokker design and carries a cabin in its center section for the crew and military equipment. Wheels retract into the engine nacelles. Performance is estimated to include a maximum speed of 290 mph and a range of 870 miles.

Britain exhibited one of its latest bombers, the new twin-engined Bristol *Blenheim,* an all-metal mid-wing monoplane powered by 835 hp Mercury engines. Other exhibits were from manufacturers in Poland, Russia, and the United States, the Curtiss-Wright Corp. being the only American exhibitor at the show with its Series G Cyclone and two models of Wright Whirlwind engines.

Engines ranged from 20 to 1300 hp. Ten were liquid-cooled, three were Diesels and the balance air-cooled. Bristol products attracted as much interest as the Wright engines and the Walters of Czechoslovakia.

# FOREIGN NEWS IN BRIEF

## Australasia

During the year ended June 30, 1936, Australian airplanes flew 3,034,011 miles in scheduled flying and carried 21,669 passengers and 420,183 lbs. of freight. This compares with 1,721,065 miles, 15,423 passengers and 210,634 lbs. of freight in 1934-35. Number of civil aircraft registered on June 30, 1936 was 268. There were 78 airports and 154 landing fields. Pilots' licenses current numbered 989; since March 28, 1921, 2,140 pilots have been licensed (1,151 licenses have lapsed or been cancelled or suspended). Present licenses number 725 private and 264 commercial. There were also 23 navigators', 8 aircraft radio telegraph operators', 7 aircraft radio telephone operators' and 338 ground engineers' licenses in effect on June 30.

Progress is being made in providing safer flying and night flying facilities, and emergency landing fields are being built along the air mail routes, four airports being in a state of preparation along the North Coast route, while three will be built on the Southern route. Full night flying facilities are to be available at Archerfield, Mascot and Essendon, when the project is complete.

The Civil Aviation Board will shortly install control towers at the principal airports in each state. Bids are being taken for their erection.

Guinea Airways, in completing a 730-mile flight from Port Moresby to Townsville, Queensland, in 4 hrs. 20 min. created two records —the *Electra* was the first to land at Townsville as the first Australian landing from an overseas flight, and the first to fly from New Guinea to Brisbane in one day.

## Canada

Canadian Airways recently took delivery of a Norduyn *Norseman,* Canadian-designed freight plane built at Montreal. The ship is being used on the Mackenzie River system, and is equipped with large

(*Continued on following page*)

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(*Continued from preceding page*)

doors to facilitate loading of bulky freight. When not used as a freighter, it carries eight passengers and two pilots.

Canadian Airways, Ltd., reports that 604,403 miles were flown from Sioux Lookout, Collins and Kenora from January 1 to freeze-up, during which period, 6912 passengers were carried as well as 4,876,899 lbs. of express. Pilots logged 6532 hours.

Mail service into remote northern British Columbia starts about January 10 between Ft. St. John via Gold Bar and Finlay Forks to Ft. Grahame, and from Ft. St. John to Nelson. Service will be operated by United Air Transport, Edmonton operator which will make 8 trips per year on the first route and 4 trips on the second. Formerly these outposts received mail once a year at best.

## Czechoslovakia

Direct Warsaw-Athens service is now being operated by LOT on a weekly basis. Douglas planes make the 1160-mile trip in about 11 hours flying time. During the winter season this flight takes 2 days, elapsed time. Next summer it is expected that flying time can be cut to 8 hours and the elapsed time to one day. LOT expects to extend its service from Athens to Jerusalem about April 1, and at about the same time to start service over the Revel-Helsingfors route.



*The three-place 550 hp Navy Type 95, Japan's newest reconnaissance plane*

## Great Britain

The number of airports in Great Britain licensed for public use is 54. Of these 29 are owned by municipalities and 25 by private interests. Sixteen have radio equipment in operation.

Instruction of military pilots in flying fast medium and heavy multi-engined bombers is the purpose of the twin-engined Airspeed *Trainer,* an all-wood low-wing cantilever monoplane. It has two Siddeley *Cheetah* IX 310-350 hp air-cooled engines, driving controllable-pitch propellers.

Two pilots sit side-by-side in the nose of the fuselage, which is equipped with dual controls. A gunner is at the rear of the cabin in a rotatable gun-turret and the radio operator is amidships.

Three engines of French design are to be built by Coventry Aero-Engine & Components Co. under license from the Lorraine Co. They are the liquid-cooled, 12-cylinder Vee types *Petrel* (760 hp) and *Sterna* (900 hp) and the 18-cylinder 1350 hp *Sirius.*

First of the new Empire flying boat services to be inaugurated will be between England and South Africa. The main route will be diverted south to Kenya from the existing line from Kisumu to Johannesburg to the coastline from Mombasa to Durban, the present southern terminus of the service.

Imperial Airways flew 463,908 miles in August and 2,258,793 miles during the 6 months of the current fiscal year (beginning April 1) compared with 420,911 and 1,975,633 miles, respectively, for the same periods in 1935. Tonmileage for August and the 6 months was 485,632 and 2,250,021 compared with 482,635 and 2,250,-373 last year. August receipts amounted to $835,455 compared with $786,269 for the preceding August and for the 6-month period they amounted to $3,904,055 compared with $3,838,248 during the similar period in 1935.

## Switzerland

Swissair will buy a Douglas DC-3 for summer operation over the Zurich-London route. Results of 1936 proved that with the 14-seat Douglas DC-2 many passengers could not be accommodated so that the necessity of a larger transport arose. The new Douglas will be a standard type equipped with two 1000 hp Series G Wright Cyclone engines.


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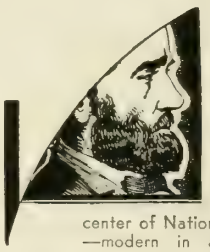
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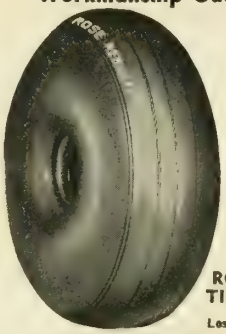
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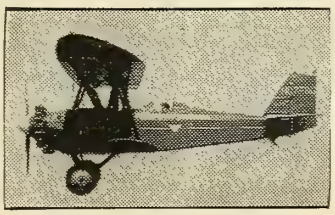
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AERONCA C-3: Six months old; has two doors, heater, brakes, compass, 8-day clock, and bank indicator. Hand rubbed and waxed finish, always hangared, never cracked. Price $1,295. Also '35 C-3, never cracked, privately owned, with heater and compass; best of care; only $1,100. Can finance either. G. L. Williams, Utica Airport, Utica, N. Y.

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BEECHCRAFT 1936 MODEL: 285 Jacobs; equipped with $2,000 worth of extras, including Sperry directional gyro and R C A radio. Total time 93 hours; color Stearman vermilion. Price $8,500. AERO DIGEST, Box 2487.

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BEECHCRAFT B-17-L: In excellent condition, with Jacobs 225 hp, major overhauled and modernized at 256 hours, with new cylinders and crankcase. Total time now 320 hours. Fabric just like new; color is red with black striping. Hangared at North Beach Airport, New York City. Extras include Curtiss metal propeller, R C A radio receiver, landing lights, three flares, Pioneer clock, synthetic leather upholstery and side walls, thermocouple and the following brand new instruments: shock proof instrument panel, turn and bank, self-contained rate of climb, 941 Pioneer compass, directional gyro, with ball bank and light, Kollsman sensitive altimeter, rotable air speed indicator, manifold pressure, outside air temperature, carburetor temperature and air time recorder; motor cover, tools and stakes. Price, $5,950. AERO DIGEST, Box 2492.

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BUHL SEDANS: 6- and 8-place. Both ships just recovered and licensed, complete with landing lights and flares. These ships are a bargain as they are like new, with very little time. Sun Batteries, 10521 Gratiot, Detroit, Michigan.

### *Cabinaire*

CABINAIRE: 4-place cabin biplane, powered Wright J6-5. Direct electric starter, new aircraft battery. Fabric excellent; motor just majored. Very quick take-off. Milton Hersberger, Put in Bay, Ohio.

### *Cessna*

C-34 CESSNA: Warner Super-Scarab. 25 hours total time. Extras. Privately owned. At Roosevelt Field. $3,500. AERO DIGEST, Box 2484.

CESSNA: Powered 125 Warner. Airplane completely recovered and engine majored in our Approved Repair Station in February this year. An excellent, economical four-place airplane. $1,095; $550 down. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

### *Command-Aire*

CHALLENGER COMMAND-AIRE: Licensed May 1937. Good condition throughout. Bargain for $500. Roy Van Houten, Midland Park, N. J.

### *Cub*

TAYLOR CUB A-40-3: 15 months old; has compass, enclosure; no student work; always hangared. Is insured against fire till next September. No crack-ups. Has 210 hours total time. $825. Burr Porterfield, Jr., Martinsburg, West Virginia.

CUB DEMONSTRATORS: A-40-4 engines; condition guaranteed like new, at saving of $200 compared with new ship. Can be financed. Somerset Hills Airport, Basking Ridge, N. J.

1934 TAYLOR CUB: A-40-2 Continental motor, no time since major. Ship in good shape. Brand new tires and propeller. Winter enclosure. Excellent performance. Licensed until May 1937. $650 cash. Going, going—George Estabrooke, 12 Prospect Drive, Yonkers, New York.

1936 CUB DEMONSTRATOR: Like new, $990. 1935 Cub, overhauled and relicensed, $750. Other bargains, 3-place jobs, cabin planes. Can finance. Write us. Bennett Air Service, Hightstown ("Cubtown") New Jersey.

TAYLOR CUB E-2: Just relicensed. Enclosure. Colors, red and silver. Will deliver reasonable distance. Can be financed. $800. Foster A. Lane, Port Columbus, Columbus, Ohio.

DE LUXE CUB: 10 hours total time. Save yourself $100. $1,240; $500 down. Will take trades. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

### *Curtiss Robin*

CHALLENGER ROBIN: All blind and night flying instruments; motor majored; flares, steel prop, safety glass, tail wheel, de luxe upholstery, new tires. Worth $1,000. Will sacrifice for $850 cash. Box 674, Shreveport, Louisiana.

OX-5 ROBIN: Licensed to June 1937. Fuselage recovered, new Flottorp prop, Scintilla mag, spare engine; 65 hours on new engine. $550. Clarence Seals, Cross River, New York.

CHALLENGER ROBIN: 185 hp. In A-1 condition. $600 cash. Write Lombardo, 164 Lexington Avenue, New York, N. Y.

CURTISS ROBIN: Four-place. A fine passenger-carrying airplane in excellent condition. $1,095. Will finance and take trade. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

ROBIN CHALLENGER: Just relicensed to November 1937. Curtiss-Reed propeller, tail wheel. 81 hours since engine majored. $995; $495 down. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

### *Curtiss-Wright*

CURTISS-WRIGHT SPORT: 3-place. J-6-E 175 hp; electric starter, turn bank, rate climb, radio shielded; excellent condition. Total 300 hours. World's Fair display ship. Privately owned. Cliff Condit, Pal-Waukee Airport, Mount Prospect, Illinois.

### *Eaglerock*

EAGLEROCK: Comet 150 hp air-cooled; steel prop, brakes; motor less than 100 hours. Licensed, ship and motor perfect. $695. Also LaSalle 1934 4-door sedan, de luxe Fleetwood body, new tires, interior and paint perfect; 1500 miles; $695. Will consider trade on good Stinson or similar closed ship. Write or wire Garth Follett, 1255 South Wabash Avenue, Chicago, Illinois.

EAGLEROCK HISSO: Just relicensed. $595; $195 down or will take late model automobile in trade. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

### *Fairchild*

FAIRCHILD 24: Inverted Cirrus 95 hp. Like brand new. Manufactured August 1933. Licensed to November 1937. Price, $1,550. Can finance part. AERO DIGEST, Box 2486.

SALE OR TRADE: Fairchild KR-31, Millerized OX-5. 25 hours total since installed new. Linen and ship in perfect condition. $390. Ralph Carnes, Ranger, Texas.

FAIRCHILD 71: Brand new year ago; worth then $13,500. Fine photographic ship. 240-gallon gasoline tanks. 2500 pounds useful load. $4,750. Rare buy. Alton Walker, 600 Graphic Arts Building, Kansas City, Missouri.

FAIRCHILD "24": Completely equipped. Motor just majored. Rose Parakeet: Excellent condition. Will trade. Loening Commuter amphibion, J-6-E motor. Waco F, blind instruments, hood, radio. Cliff Condit, Pal-Waukee Airport, Mount Prospect, Illinois.

### *Fleet*

FOR SALE: 125 Warner Fleet. Ship and engine positively A-1. Must be seen to be appreciated. Licensed May 1937. Particulars on request. Price, $1,375. J. J. Bondy, 157 Owasco Street, Auburn, New York.

FLEET: 3 POLB; B-5. Just relicensed. 39 gallons gas. Turn bank; tail wheel; duals, brakes; rate climb; navigation lights; semi-wheel. Good condition, $1,600 cash. Wanted: Perfect J-5 Travel Air. Frank Eng, 102 Blanco, San Antonio, Texas.

FLEET, KINNER powered: Just completely recovered. The finest trainer ever built. Instruments both cockpits, airwheels. Front exhaust engine. 10 hours since top overhaul. $1,450; $700 down. St. Louis Flying Service, Lambert Field, Robertson, Missouri.

### *Great Lakes*

1933 DE LUXE GREAT LAKES: Just relicensed, has steel prop, air wheels, brakes, air speed, rate of climb, bank and turn, baggage compartment; also includes 3-band aircraft radio. Sacrifice for $1,150. AERO DIGEST, Box 2483.

GREAT LAKES 2T-1A: Just relicensed to November, 1937. Hand-rubbed finish, blue fuselage with red wings. Airwheels. 32 hours on engine since complete major. An excellent ship. $895. Can finance one-half or will take airplane or late model car in trade. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

GREAT LAKES Bomber: Converted to commercial plane; powered with CA Hornet; 71 hours total time on ship and motor; ship and engine in excellent shape and a good load carrier. General Airmotive Corporation, Municipal Airport, Cleveland, Ohio.

### *Kellett*

KELLETT AUTOGIRO: Late model; 225 Continental engine. Ship in A-1 condition, never cracked; total time 627 hours; licensed to July, 1937. Engine new this spring. Total time 117 hours. Starter and complete instruments. Duals and side-by-side seating. Priced right for quick sale. Licon Air Service, Inc., Islip, New York.

**22 CLASSIFIED ADS WERE OMITTED FROM THIS ISSUE BECAUSE OF LATE ARRIVAL.**

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**AVOID THIS BY SENDING YOUR COPY EARLY.**

*February forms close January 18th*

### *Laird*

LAIRD, WRIGHT 330: 197 hours guaranteed time since new. Beautiful high-gloss finish. Turn and bank, rate of climb, electric starter. $2,975. Can finance one-half or will take late model car in trade. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

### *Loening*

LOENING AIR YACHT: Powered with Wright Cyclone. Ship and engine completely overhauled by owner and prepared for salt water; ship now working in south; price, $4,750, including complete spare Cyclone. General Airmotive Corporation, Municipal Airport, Cleveland, Ohio.

LOENING COMMUTER: J6-9; amphibion, 300 hp Wright Whirlwind. Turn and bank, rate of climb. Time since motor major, 67 hours. NC10249; $2,000. Loening Commuter Amphibion, 350 hp Wright E motor. Blue hull, silver wings. Total time, 446 hours; 125 since factory overhaul. Rate of climb, turn and bank. Good condition. NC13140; $2,000. O. J. Whitney, Inc., North Beach Airport, Jackson Heights, N. Y. NEwtown 9-0300.

### *Monocoupe*

MONOCOUPE 1936: 90-A, de luxe. 4 months old; like new. Price, $3,500. White Flying Service, Inc., Caldwell-Wright Airport, Caldwell, N. J. Telephone: Caldwell 6-1560.

VELIE MONOCOUPE: Licensed July '37. Motor 2½ hours since majored. New propeller; new upholstering; covering year old. $300 cash in Washington, D. C. William Cook, 2701-14th Street, N. W.

MONOCOUPE: Powered with Warner Super-Scarab 145 motor. Ship's time less than 200 hours since new. Equipped for night flying. Bonded, shielded for radio. Radio receiver installed. Tunnel cowling. Very clean. Becker-Forner Flying Service, Jackson, Michigan.

FOR SALE: Late model D-145 Monocoupe, powered with 145 hp Warner motor. Equipped for night flying, also radio-equipped. Built to cruise 140 mph; top 160. Well streamlined. Price, $2,850. AERO DIGEST, Box 2495.

### *Moth*

MOTH, GIPSY: Just recovered. 100 hours since engine major, $745; $200 down or will take late model car in trade. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

### *N-B Trainer*

BARLING NB-3: Low wing, Genet-powered, three-place. Engine just majored, airplane completely recovered, reupholstered. Will accept 1936 automobile in trade or can finance one-half. $795. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

### *New Standard*

J-5 STANDARD: Excellent motor, fabric good, steel propeller, direct electric starter, landing lights, flares, Air Tours, Inc., Put in Bay, Ohio.

### *Pitcairn*

FOR SALE: J-5 Pitcairn. Good condition. Airwheels, brakes, tail wheel, navigation lights, battery, duals, 30 hours on motor since major. Warren Porter, P. O. Box 22, West Palm Beach, Florida.

### *Rearwin*

REARWIN SPORTSTER: LeBlond 85. Tail wheel, speed ring, brakes, compass. New April 2nd. 421 hours, perfect; motor just majored. $1,900. Will deliver 500 miles. No trades. Pueblo Flying Service, Pueblo, Colorado.

REARWIN SPORSTER: 11 months old. Powered with LeBlond 70. Only 190 hours total time. Guaranteed perfect. $1,685; $850 down. Will take trade. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

### *Wiley Post*

WILEY POST: 40 hp. Ford motor. Excellent condition. 400 hours total time. Price, $600. Clifford Giblet, 817 N. W. 41st St., Oklahoma City, Oklahoma.

### *Ryan*

RYAN STA: 125 hp. Menasco; perfect condition throughout; less than 200 hours; no cracks; always hangared. Priced at $3,000 at Minneapolis. W. M. Miller, Cloquet, Minn.

B-1 RYAN J-5: Cabin monoplane, 5-place, excellent condition; full of extras; licensed to September 1937. $975. May consider trade or finance. Fred Rigler, 1049 Lincoln Place, Brooklyn, New York.

RYAN J-5 B-1: For sale or will trade. Prefer J-5 Waco Straightwing or what have you? Box 582, Monroe, Louisiana.

FOR SALE: Ryan, Wright J-4-B; in excellent condition. For details, write L. J. Hood, Luthersville, Georgia.

RYAN B-7: Licensed to October '37. Condition perfect. Wasp B motor, 21 hours since factory majored. Electric and hand inertia starter. Folding wing, landing lights; upholstery perfect. As new ship. Cannot be appreciated without seeing. Price, $2,500, or will trade for two 40-B Boeings, J-5 Travel Airs or Stearmans. Finklea Brothers, Leland, Mississippi.

### *Sikorsky*

SIKORSKY AMPHIBION: 300 hp Pratt-Whitney Wasp Jr. motor. Landing lights, turn and bank, rate of climb; red leather upholstery; maroon hull, cream wings; excellent. NC806W; $8,500. S-39 Sikorsky, Pratt-Whitney 400 hp motor; gray hull, silver wings; RCA radio. Turn and bank, rate of climb, long-distance gas tanks, special streamlining; beautifully finished. Total time since complete overhaul, 290 hours. NC809W; $13,000. O. J. Whitney, Inc., North Beach Airport, Jackson Heights, N. Y. NEwtown 9-0300.

### *Spartan*

SPARTAN LOW WING: Side-by-side; relicensed; red wings, black fuselage. Powered Jacobs 75 hp, just majored. $900. Foster A. Lane, Port Columbus, Columbus, Ohio.

### *Stearman*

STEARMAN C-3-B: Wright J-5; total time 400 hours. Motor has 190 hours since major at Wright factory. Just top overhauled. Ship bought from original private owner. Price $1,200. Will accept trade. Andrew Stinis, Floyd Bennett Field, Brooklyn, New York.

### *Stinson*

1935 SR-6: Privately owned Stinson Reliant, NC-15122; $5,885. Cost nearly $9,000 with extras, including standard instruments plus Kollsman sensitive altimeter; Smith controllable propeller; 100-gallon tanks, flares; landing lights, R C A radio, turn and bank; red and cream finish with matching red leather upholstery; purchased new from Stinson September, 1935. Never cracked; flown by one pilot only; maintained without regard for cost; used for personal travel only. M. Reynolds, 542 S. Dearborn St., Chicago, Illinois.

STINSON SM8A: Perfect condition throughout; high lustre black and red finish, cabin just reupholstered in red leather; new crackle-finish instrument board with complete blind flying instruments. Landing lights, flares, radio. Exceptionally smooth Lycoming. Semi-air wheels, brakes, etc. This is unquestionably the finest SM8A in the country. $1,700 cash, no trades. Lenox Hodge, Radnor, Pennsylvania.

LIKE NEW: NC14583, SR-5-B, controllable propeller, flaps, radio, blind instruments, lights, flares, 75-gallon tanks. 264 hours total, 114 since factory top. Used for personal travel exclusively. Carefully maintained. Never scratched. Bargain. J. B. DaCamara, Laredo, Texas.

TRIMOTOR T: NC11167. Ten-place, may be licensed for 11. Less than 150 hours since majors. Wing recovered last April. Radio, airline equipped. New tires. New external non-heating brakes. Never cracked. Clean. Bargain. K. M. Oliver, Laredo, Texas.

LATE STINSON SR: Purchased late October from Stinson Corporation. Motor majored and ship reconditioned throughout. Full set instruments, radio, retractable landing lights, flares, leather upholstery; trim orange and blue. Business reasons for selling. Price right for cash only. Stockert Flying Service, South Bend, Indiana.

STINSON S: Bonded, shielded, retractable lights, flares, bank turn, rate of climb, ring, wheel fenders, recently majored. New type pistons, heavy crankshaft; excellent condition; $1,675. Stinson Reliant, de luxe model, 72-gallon tanks, radio, generator, lights, flares, blind instruments, Kollsman sensitive altimeter, clock; bargain, $2,700. Kenneth Wright, Taylorcraft Aviation Co., Alliance, Ohio.

STINSON SM8A: Lycoming. 50 hours since major. Ship and motor perfect. Night flying instruments, airwheels; recently recovered. Total, 840 hours. $1,600. Will trade. Norman Peters, 2425 Chase Street, Toledo, Ohio.

1936 STINSON SR7B: Long range model. Gunmetal gray and white; a beautiful plane in perfect mechanical condition. Privately owned, never damaged, carefully flown and maintained. Controllable pitch propeller, RCA radio, Kollsman altimeter and compass, Pioneer bank-turn, climb indicator and air speed; plus manifold pressure gauge. Carburetor air temperature gauge and thermocouple. Special blue leather cabin finishings. Lycoming 245 hp (R-680-B6) used only 129 hours. $6,190. National Air Service, Inc., Wayne, Michigan.

TRIMOTORED STINSON airliner: Perfect condition. Landing lights, flares, turn and bank, rate of climb, radio. $2,650. Will finance and take trades. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

STINSON SM8A: Recently recovered; high-lustre finish. An excellent and attractive four-place job. $1,495. Can finance or take trade and will consider late model car. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

STINSON RELIANT: '33 model, completely bonded, shielded for radio. Radio receiver installed. Also equipped for night flying. Ship slightly damaged. Trades accepted. Michigan Aero Motors, Jackson, Michigan.

STINSON MODEL S: Built late 1932; 550 total hours; motor has 35 hours since major by leading airline. Heavy-duty crankshaft and forged pistons. Equipped with radio, bank and turn, rate of climb, generator, large gas tanks, leather upholstery, fenders and Reliant cowling ring. Just relicensed; splendid condition. Price, $1,875. Will accept trade. Andrew Stinis, Floyd Bennett Field, Brooklyn, New York.

STINSON SR-5-E: Lycoming motor. Cream fuselage, gold trim, wings red. Total time, 349 hours; 96 hours since top overhaul. Many extras; new tires, flaps, 75 gallons gas capacity. Ship in excellent condition. NC13858; $3,500. O. J. Whitney, Inc., North Beach Airport, Jackson Heights, N. Y. NEwtown 9-0300.

## *Travel Air*

TRAVEL AIR HISSO: Excellent condition, night equipment; $700. Ben Hess, 445 Debaliviere, St. Louis, Missouri.

J6-5 TRAVEL AIR E-4000: Excellent condition. Recovered last winter. High gloss finish. Engine brand new 290 hours ago. Brakes, duals, steel prop, navigation lights, vertical radio antenna, clock, compass, air speed, radio shielding, hand inertia. Gas capacity for 600 miles. Licensed. Never cracked and definitely in excellent condition throughout. $1,400. Loren Jones, care of Emrick Flying Service, Central Airport, Camden, New Jersey.

TRAVEL AIR Sport Trainer: Wright Gipsy engine, semi-air wheels, brakes, engine just majored. $950; will take cash and car or plane in trade. J. W. Lytle, 2333 Vodeli Street, Pittsburgh, Pennsylvania.

TRAVEL AIR 4000-W: Warner Scarab. Licensed till July '37. 75 hours since motor completely rebuilt. Standard instruments, steel prop. $900. Jack Crall, Longmont, Colorado.

$100 TO $500 DOWN gives you possession of J-5, J6-5, Challenger, Siemens-Halske, or OX Travel air, open, cabin. Write, wire, call Pioneer Aviation, Airport, Syracuse, New York.

CURTISS-WRIGHT Travel Air 16-K: Relicensed; Kinner 125 hp; high luster finish, orange and black; 3-place. Bargain, $1,375. Foster A. Lane, Port Columbus, Columbus, Ohio.

TRAVEL AIR J6-5: Licensed to July 1937. Semi-airwheels, steel propeller, bank and turn, rate of climb, brakes. Engine perfect condition with 125 hours since major. $1,195. Can finance one-half and will take trade. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

TRAVEL AIR: Just recovered, painted aluminum all over. 30 x 5 Bendix wheels, brakes, standard instruments; Wright J-5 engine just overhauled and cylinders are standard bore, showing less than .002 wear; Standard Steel propeller that has just been reconditioned; will be licensed about January 15th. For $1,500. Aviation Associates, Inc., Curtiss Airport, East St. Louis, Illinois.

## *Verville*

J6-7 VERVILLE CABIN: Good shape, licensed; extras. Less engine, $795 flyaway delivery. Buck, care Stratford Apartments, Madison, Wisconsin.

## *Waco*

WARNER WACO F: Newly majored and covered; in perfect shape. $1,450. Witch Duck Aeroplane Corporation, 248 Bank Street, Norfolk, Virginia.

WACO F-2: 165 h.p. Continental motor. Hamilton steel prop. Motor 30 hours since major. Ship just relicensed. 675 hours total time. Price $1,900. Clifford Giblet, 817 N. W. 41 St., Oklahoma City, Okla.

WACO GXE: 15 hours since recovered by approved repair station. New OX with Scintilla mag. Licensed to September '37. Perfect condition. Aeromarine Klemm, airwheels and brakes, speed ring. Licensed. Powered with late Velie 70. Also late cam type Challenger motor, complete with starter, steel prop. Will accept ship or late car in trade. Harry Deuter, 318 West Washington, Fort Wayne, Indiana.

FOR SALE: 1936 Custom Waco Cabin, 285 Jacobs; radio, special instruments, 95 gal. gas tanks. Less than 40 hours on ship and engine. Reason for selling, owner gone abroad, will sacrifice for quick sale or trade. Little-Greiner Flying Service, Municipal Airport, Springfield, Ohio.

FOR SALE: Waco GXE, reasonable. For further information, write H. C. Halwick, 22 Meadow Lane, Pittsfield, Massachusetts.

WACO DSO: Hisso 150. Perfect condition. Very good performer. 30 hours since major on engine. Maroon fuselage, silver wings. Unusually smooth Hisso, very easy on oil. A real bargain at $800. Lenox Hodge, Radnor, Pennsylvania.

FOR SALE: Warner Waco F, in A-1 condition. Sell reasonably or trade for faster ship. Rising Sun Motors, 881 East Luzerne Street, Philadelphia, Pennsylvania.

WACO 9: OX-5. Licensed to July 1937. Both plane and motor in excellent condition. Best performing OX job in country. Price, $325. Will deliver for expenses. Elwyn West, Route 3, Appleton, Wisc.

WACO F-6: 225 Jacobs, de luxe job. Special tanks, 75 gallon capacity. 80 hours total time. Must be seen to be appreciated. Make offer. William Shaw, 3821—35th Avenue South, Minneapolis, Minnesota.

1933 WACO DE LUXE Cabin: Continental 210 hp. Hours since major, 103. Wheel pants, large gas tanks, starter, landing and navigation lights, radio, bank and turn, rate of climb. $2,495. Must sell; need cash. Can arrange finance. Might trade small ship. Leeward Flying Service, New Kensington, Pennsylvania.

$150 TO $500 DOWN is all you need to secure an air-cooled, water-cooled Waco airplane. Call, write Pioneer Aviation, Airport, Syracuse, New York.

WACO CABIN 1934: Like new. Jacobs 225, modernized; full set instruments, radio, pants, flares, Reed prop. $3,600. Red Bank Airport, Red Bank, New Jersey. Phone: 1730.

WACO F: Warner 125 hp. Licensed to October 1937. 500 hours since new. Ship never cracked; only two owners, $1,350 cash. Also, Heywood air starter and tank for 5-cylinder engine, $45. W. W. Edmondson, Clover, Virginia.

1934 WACO YKC: 4-place cabin; 285 hp Jacobs motor; 50 gallons gas capacity; turn and bank, rate of climb, landing lights, flares, Lear radio, sensitive altimeter; Waco red, black striping; red leather unholstery. Total time 218 hours; excellent condition. NC14053; $4,500. 1936 Waco Custom, 285 hp Wright motor; controllable propeller, turn and bank, rate of climb, flares, landing lights, RCA receiver, clock, thermocouple, manifold pressure gauge, carburetor temperature gauge, cactus-proof tires; special Diana cream with blue striping. Beautifully finished throughout. Total time 75 hours. Like new. $7,500. O. J. Whitney, Inc., North Beach Airport, Jackson Heights, N. Y. NEwtown 9-0300.

WACO F: Kinner. Excellent condition. 64 hours since major. Brakes, steel propeller. Just relicensed. $1,375; $687.50 down. Will take trade. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

## *Miscellaneous Aircraft*

HEATH: Identified, perfect condition; factory welded fuselage; Heath Henderson motor and prop; flyaway, $195. Similar sport plane less motor, $65. Three Ford V-8 marine converted motors, cost new $295 each, make offer. H. Lindbergh, Livermore, California.

WACO F WARNER: $1,200. '30 Lambert Monocoupe, $1,500. Buhl Pup, $395. J6-5 Travel Air, $1,150. Two OX Waco's, clean, make offer. LeBlond Davis, $750. Harold Alford, Stinson Airport, LaGrange, Illinois.

1933 STINSON RELIANT: Fully equipped. J6-5 E-4000 Travel Air. 125 hp. Warner Waco F. 1936 Aeronca, like new. J6-5 Robin. Stinson SM8A. Arrow Sport with less than 50 hours. OX Robin. All these ships in first class shape, priced right. Also Wright J-6 parts and 15-watt type RCA transmitter. Will buy cracked Warner motor or parts. Burnham-Miller Flying Service, Omaha, Nebraska.

LICENSED non-restricted airplanes: J-5 Travel Air, majored, recovered; $1,095. Waco F Kinner, majored; $1,095. Tank OX American Eagle long nose, refinished, extras; $395. OX Waco 9, perfect; $345. OX Eaglerock, airwheels, extras; $345. Every ship guaranteed. Edo floats for Stinson, like new; $725. Merle Zuehlke, 1510 South 55th Street, Milwaukee, Wisconsin.

VERVILLE J6-7 Air Coach: Starter, generator, 125 hours since major; ship A-1 condition; $1,250. Porterfield LeBlond 70, 225 hours, perfect shape, demonstrator; speed ring, air speed; $1,250. Fleet Kinner K-5, front exhaust; air wheels, duals, standard instruments; ship recovered, motor majored by approved station, high gloss finish, perfect condition; $1,400. H. Bender, 4429 Westway, Toledo, Ohio.

NATIONAL AIR KING: Overhauled OX-5; airwheels, dual controls. Good flying condition; identified. $250. Also cracked Franklin Sport, 65 Velie, airwheels, $100. Airport Service Station, Parkham Road, Warren, Ohio.

IF YOU ARE THINKING of buying a plane in the $1,500 class (cash or on time) let us demonstrate the new 1937 Arrow Sport V-8. Let economy and value be your guide! Particulars, G. D. Kelsey, Philadelphia Airport, Philadelphia, Pennsylvania.

KINNER PLAYBOY: Kinner's 1936 special show job. 218 hours total time; licensed to November 1937. Motor and plane perfect. Bargain. Consider older plane or late model used car on deal. Challenger Travel Air; bargain. Ship and motor best of condition. Licensed to November 1937; will take in car on deal. Model SM8A Stinson, bargain. Lots of service in this ship. Will trade. 125 Warner Monocoupe; air wheels, steel propeller, electric starter, shielding, bonding, and radio. Motor recently overhauled. Beautiful ship. 1936 Cessna C34; equipped with turn and bank, sensitive altimeter, air temperature gauge, manifold pressure gauge, clock, radio shielding and bonding, engine driven generator and ammeter. Approximately 150 hours. Bargain, privately owned. 1936 Cessna C34. No extra instruments or equipment except shielding and bonding. Approximately 40 hours. Bargain; privately owned. 1936 Lambert Monocoupe; approximately 150 hours; first class shape; no extra instruments except heater and tail wheel. 1933 model Warner Monocoupe. Yellow with red striping, metal propeller, and wheel pants. Bargain. Cessna Aircraft Company, Wichita, Kansas.

FOR SALE: Waco '35 UKC, 210 Continental; flares, all lights. J6-7 Standard 5-place. BK Bird. All ships priced for immediate sale; trades considered. Guy Bolt, Beckley, West Virginia.

REPOSSESSED Porterfields, Cubs, Ryan B-1, Wallace, Kinner B-5 Bird, Aeronca, Challenger and Eaglerock OX-5's, Travel Air biplane (150 hp), Aeromarine Klemm and Stinson SR-5 airplanes. J6-7, Kinner, Continental A-40-2, Cirrus Mark III motors. Airplane parts for Moths, Avians, Stinson and American Eagles. Small down payment and balance monthly on anything we have. Motors and planes repaired on finance plan. Write Aviation Finance Co., Hemlock, New York.

1936 STINSON: 6 months old, 5-place, leather upholstering, Hamilton controllable; 100 hours; lights, flares, bonded, shielded; cost $8,400, now $6,500. Waco F, 125 Kinner: Just recovered, new condition throughout, $1,450. J-5 Travel Air: Good, $1100. J-5 Waco: Like new, special paint, new engine, starter and other extras, $1,800. Taylor Cub: 6 months old, looks new; finished yellow, black stripe; $875. Blue and yellow Cub, same as new, 55 hours total time, privately owned, $925. OX Waco, $325. Aeronca, 2-place, licensed, heater, enclosure, $600. Meinke-Eldred Flying Service, Inc., Willoughby, Ohio.

SPORTPLANES, $55 UP: OX-5 jobs, $100 up. Hundreds of others. Terms. Big Winter Directory, just out. Rushed anywhere for 25c, postpaid. Used Aircraft Directory, Athens, Ohio.

FOR SALE: De Luxe Davis, LeBlond 65, just recovered and licensed, $750. Also Velie Monocoupe, in perfect condition. New airspeed and navigation lights. Licensed, $475. Kewaunee Air Service, Kewaunee, Wisconsin.

FOR SALE: Waco GXE, licensed to December 1937. Millerized, $425. Buhl Pup, licensed to November 1937, $425. Both ships in excellent condition. Wanted: Lambert 'Coupe, Waco F, any condition. Harold Ownby, Peoria Airport, Peoria, Illinois.

SWALLOW OX: Excellent condition, cheap. Eaglerock OXX-6, licensed. Others. Irvin seat pack. Delivery for expenses. Howard Quick, 57 Second Street, Walden, New York.

THE "MYSTERY SHIP": All metal low wing 4-place cabin; complete set blind flying instruments. Sacrifice for quick sale. For details address Karl Voelter, Box 1093, Miami, Florida.

WACO F, WARNER: Has air speed, bank turn. Stinson S, perfect condition. Stinson SM2AB, 4-place, J-5 engine, overhauled and recovered. Rover Driggs. 1935 Aeronca. J6-5 Aristocrat. Miscellaneous equipment. Air Activities Airport, West Chicago, Ill.

WACO CABIN: On floats or wheels. J-5 Stearman; Travel Air 6000; Jacobs Bird; Moth; Avian; J6-7 Cessna; '35 Taylor Cub. Others. Chuck O'Connor, Municipal Airport, Westfield, Mass.

'34 WACO CABIN Jacobs; '34 Stinson Reliant; 225 Jacobs Beechcraft; Waco F-2 Continental; '35 Lambert Monocoupe; '34 Aeronca; '35 3-place Fairchild, 145 Warner motor; Stinson SM8A; Bellanca Skyrocket; Rearwin Sportster, new, 85 LeBlond. Aircraft Sales Co., Hangar D, Roosevelt Field, Mineola, New York.

BARGAINS: New Great Lakes, 6 months old, $1,970. New Taylor Cub, six months old, $950. Bull Pup, perfect condition, $450. Take trades. Philip Miraglia, 208 Irvington Drive, Tonawanda, N. Y.

WACO CABIN 1933; Fairchild 22; 1936 Taylor Cub. Ray Hylan, Municipal Airport, Rochester, N. Y.

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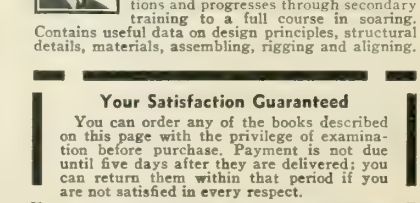
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Fairchild Aerial Camera Corporation
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Grumman Aircraft Engineering Corporation
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St. Regis Paper Company, Incorporated
Seversky Aircraft Corporation
Sperry Gyroscope Company, Incorporated
Standard Oil Company of New Jersey
Switlik Parachute and Equipment Company
United Aircraft Manufacturing Corporation
Sikorsky Division
Chance Vought Division
United Fruit Company
United States Navy
United States Coast Guard

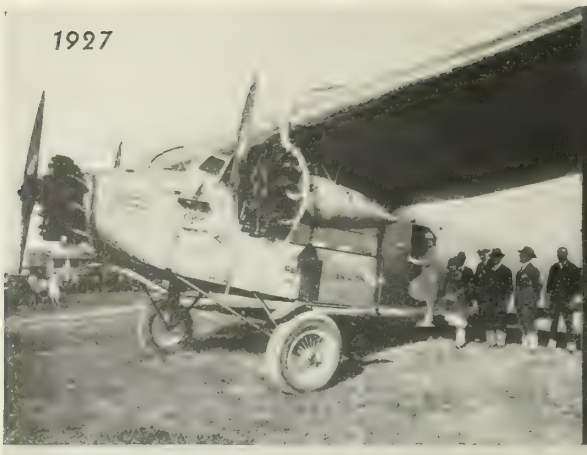
For the years to come we pledge ourselves to a strict adherance to the quality of products with which the name of Brewster has been identified for more than a hundred years.*

**BREWSTER AERONAUTICAL CORPORATION**

*Designers and Manufacturers of Aircraft Parts*

LONG ISLAND CITY NEW YORK

*BREWSTER & CO., Carriage Builders, founded 1810




*October 19, 1927, the first Pan American plane —Key West, Florida, to Havana, Cuba*

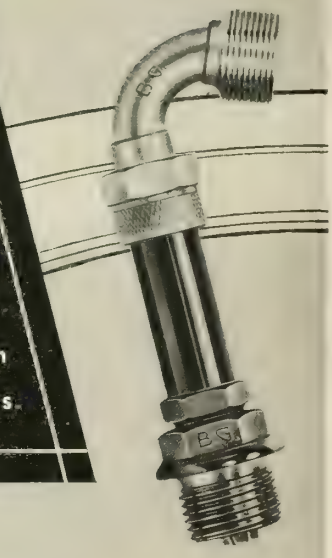



*The newest Pan American plane, Pratt & Whitney powered, San Francisco, California, to Manila, Philippine Islands*




## THEN AND NOW

In 1927, when Pan American's first plane flew from Key West to Havana, and in 1936, when Pan American's newest planes are flying between San Francisco and Manila—and in all the years between—B. G. Mica Aviation Spark Plugs have been standard equipment on all Pan American planes.



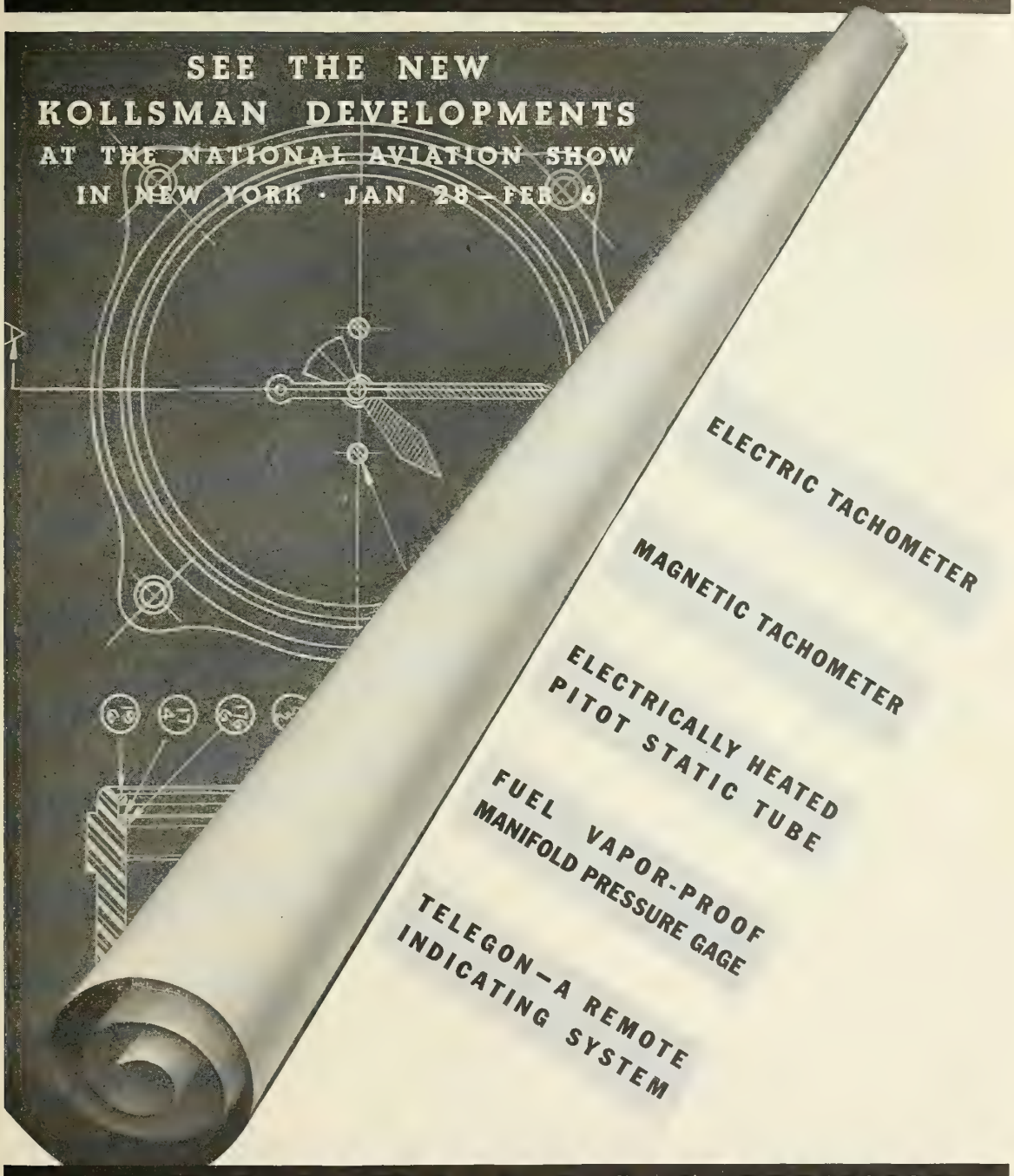

B G

# THE B. G. CORPORATION

*Contractors to the United States Army and Navy and Aircraft Engine Builders*

136 W. 52nd ST., NEW YORK  Cable Address: Golsteco, New York

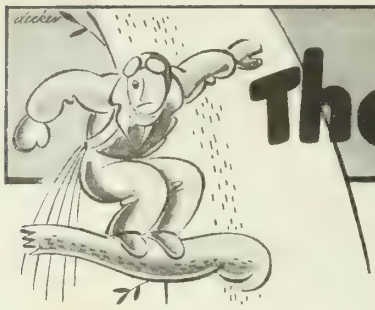
# AT THE SHOW




KOLLSMAN PRECISION AIRCRAFT INSTRUMENTS

KOLLSMAN INSTRUMENT COMPANY, 5 JUNIUS STREET, BROOKLYN, NEW YORK

WESTERN BRANCH, 1224 Airway, Glendale, California



# The Birdmen's Perch



**Say, how about pulling the old brain out of a spin and sending me some news from your neck of the woods. We can always use more gossip, strange happenings and whoppers for this page. And the rest of the fellows will be tickled to hear from you. Send the billet-doux to:**

MAJOR AL WILLIAMS, *Manager, Aviation Department,* Gulf Aviation Products, Gulf Building, Pittsburgh, Pa.

## YOU'D HIDE OUT, TOO

"A popular official of a well-known plane company was bragging to a bunch of the boys about the reliability of the compass installed on his particular make of ship.

" 'Why,' he said, 'The other day I set out on a 180 degree course for Oshkosh*, held the ship directly on the compass-reading, and two hours and five minutes later hit Oshkosh right on the nose.'

"Well, the boys found this hard to swallow, so they went out to check the compass. I'm a son-of-a-gun if the compass hadn't been stuck since its installation thirty days before, and all the instrument experts at the factory couldn't unstick it.

"The result—he had a new compass installed in his ship and has been awfully hard to find ever since."

*For real name of town (and name of official, too) write Al Jones, 725 Eighth Street, Hickory, N.C., the contributor of this yarn.



**POPULAR TWINS**

Together, Gulfpride Oil and Gulf Aviation Gas are used on an overwhelming majority of the scheduled air miles flown by airlines operating exclusively in territory East of the Mississippi . . . the territory where Gulf products are sold. A swell oil. A swell gas. A swell record.

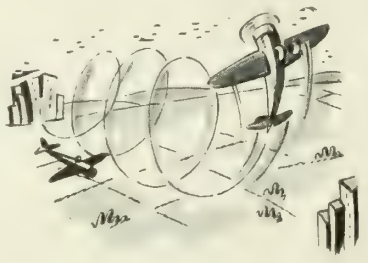
## THE DIZZIEST GUY ON EARTH

This story sounds nuts to the editors, but the narrator swears it's true. Can any one give us the real lowdown on it?

It's about a mail pilot who used to be on the Chicago to St. Louis run. For months he arrived on schedule and his reputation as a flier was ace-high. Then one day he reached St. Louis half an hour late. The next trip he was an hour late. The next one, an hour and a half. And then he began pulling in regularly about two hours behind schedule.

The officials began to wonder if he didn't have some girl whom he was courting on company time. So one day when he left Chicago, they sent a ship to trail him.

Our pilot took off nicely and climbed to about 15,000 feet. Then he went completely screwy. He looped the ship for



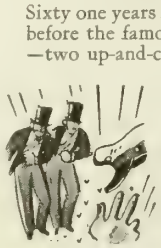
no apparent reason. As soon as he'd completed this loop, he looped again. And again. And again. All the way from Chicago to St. Louis, he kept it up, till the pilot trailing him got dizzy watching.

He landed in St. Louis two and a half hours late, reeled out of the cockpit, and yelled, "I've done it, boys, I've done it. I've looped a plane all the way from Chicago to St. Louis. Now I can retire happy."

And retire he did. Just before the company beat him to it.

## THOSE SMART FRENCHMEN

Sixty one years ago this month—27 years before the famous flight at Kitty Hawk—two up-and-coming Frenchmen filed a patent for an airplane.



It was to be a low wing monoplane with two variable-pitch, metal propellers, placed in the leading edge; a fixed horizontal fin; double vertical fins; rudder and rudder bar; closed fuselage; tail skid; *and even a retractable landing gear.*

Sounds almost like the specifications for a speedy ship of today, doesn't it? Even if the plane never did get off the ground, we say "hats off" to these forward looking inventors.

## THIS MONTH'S WHOPPER

"One afternoon this fall just before the lakes up here in Canada started to freeze, we were trying to finish a job of survey.

"Well, we were flying along nicely when, blooie, the old boiler quit. So we looked around for a spot to sit down, and could see nothing but a small lake below. So down we went.

"We found our gas tanks dry, so we went ashore and slept till dawn. Only to find that the lake had frozen over and that our floats were stuck solidly in the ice.

"Rummaging around, I found a small bottle of Gulf Aviation Gas, which I occasionally use as a gargle and mouth wash. So we poured this gas in the tank and started the motor, hoping to break the ship free from the ice.

"When we gave her the gun, the old girl jumped straight in the air and cleared the trees on the shore by at least four hundred feet.



"And was I amazed to look down and see the whole lake still frozen to my pontoons and being carried along in the general direction of Yuma, Arizona.

"Now if you think I am lying, you can check and see where a rain fell out of a blue sky 700 miles Southwest of this lake and saved a wheat crop from drought. You see, a bright sun finally melted the ice."

—Al Cheesman, Port Arthur, Ontario

**Gulf Oil Corporation and Gulf Refining Company . . . makers of**

GULF **GULF AVIATION PRODUCTS**



# there is OPPORTUNITY for you

THE PARKS FLEET OF TRAINING PLANES

## in Aviation —with PARKS AIR COLLEGE training

### Training for the Four Fields of Aviation

**The Professional Flight and Executive Course**

This course provides foundation training for airline piloting. In it is secured 96 weeks of closely supervised flight instruction coordinated with an intensive ground school schedule in essential related subjects.

**The Aviation Operations and Executive Course**

This course is offered those who see their opportunity in the operating field of air transport, other than piloting, and in the **business** of aviation. Dispatching, meteorology, traffic and field operations are some of the openings available to the graduate.

**Master Mechanics' Flight Course**

The development of skills in *all* branches of aviation mechanics is given especial attention in this course. More than that, there is provided the broad basic training which develops the perspective necessary for advancement to supervisory positions.

**Aeronautical Engineering Course**

A well balanced course that proceeds thru basic engineering subjects to extensive work in applied engineering courses, special attention being given to airplane design. Worthy of note is the liberal amount of time devoted to practical manipulative courses.

To those who possess the advantage of Parks training, aviation has given a new meaning to the excellent word "OPPORTUNITY".

For in aviation there are problems to be solved and problems are opportunities for those who can help solve them. As aviation grows, doubles and trebles in size, pyramiding to ever greater proportions, so are its problems . . . and therefore its opportunities . . . multiplied.

And Parks Graduates are taking advantage of these opportunities. You will find them in the organizations of practically every air transport and aircraft manufacturing company in America as well as in important individual enterprise. They are constructive factors in aviation. They are helping build this great new industry still greater.

Aviation executives recognize the ability of Parks graduates and value their services. They know that each one has secured a broad educational background, together with practical training, and so is well qualified to assist in the solution of problems in the division of aviation for which he has trained.

Often executives compete with one another for the services of the available Parks graduates. At times every member of a class is spoken for and placed in aviation before the date of graduation.

So, for the Parks trained man aviation lends a new, a positive meaning to the word "*Opportunity*" and this opportunity will be yours when you are being graduated by Parks Air College.

Because you are considering aviation as the field for your career and because you want to be assured of abundant opportunity in it, you are invited to send for the Parks catalog. It will give you complete information about Parks Air College including the outline of each course offered.

*Fill in the coupon, clip and mail NOW, before you turn the page. It will bring you your copy of the Parks catalog.*

Fully approved as a Transport, Ground and Flying School and Mechanics' School by the U. S. Dept. of Commerce.

Accredited by the Illinois Superintendent of Public Instruction.

*Visits of inspection are welcomed.*

Spring Term March 29
Summer Term July 5

**PARKS AIR COLLEGE**

WORLD'S LARGEST COMMERCIAL AVIATION SCHOOL

SECTION 2 AD — EAST ST. LOUIS, ILL.

Please mail me, without charge, the Parks Air College catalog.

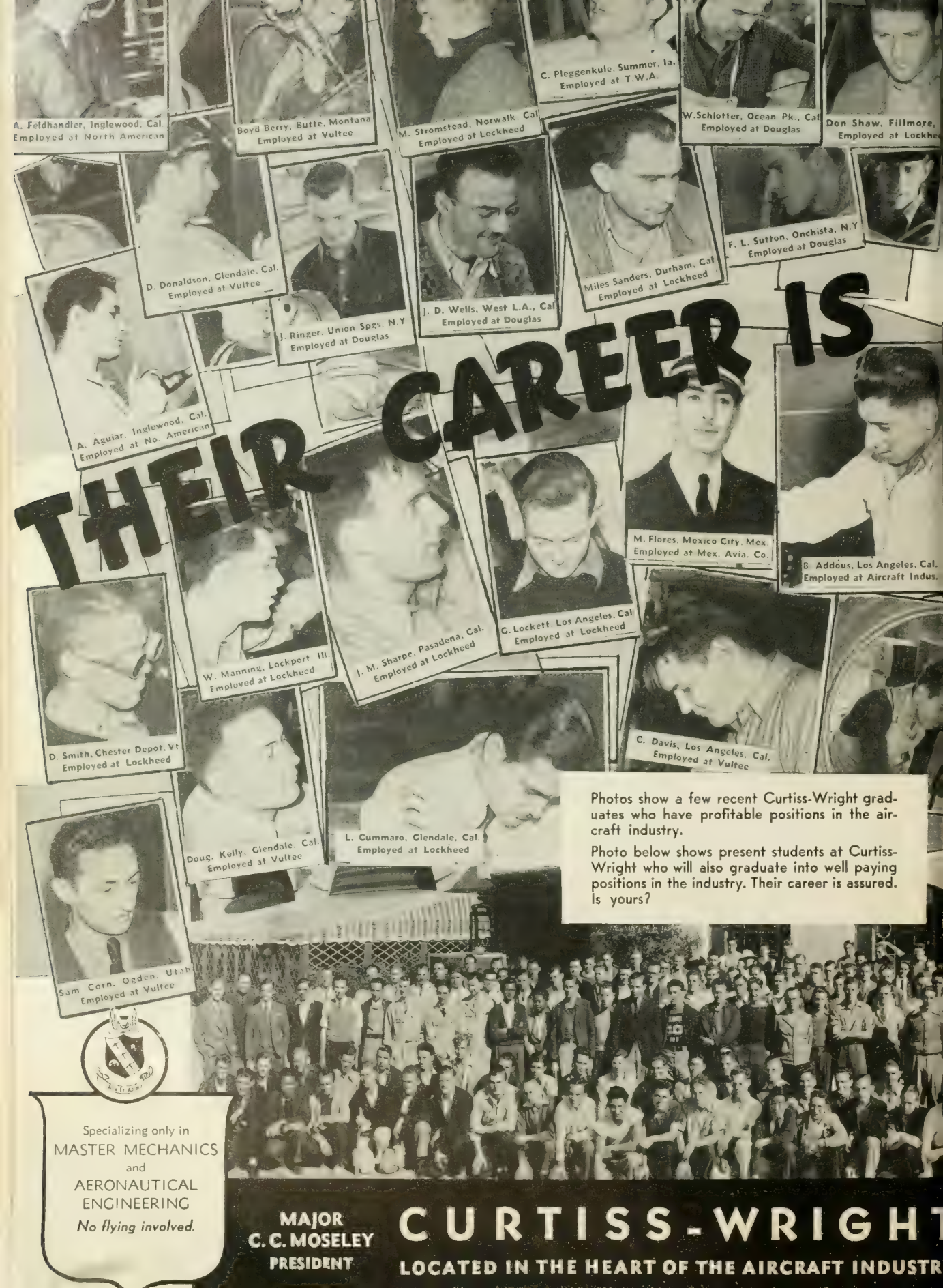
Name_____ Age_____

Address _____

City_____ State _____

Four major courses, each leading to the Bachelor of Science degree are offered:

- Professional Flight and Executive
- Aviation Operations and Executive
- Master Mechanics' Flight
- Aeronautical Engineering




Photos show a few recent Curtiss-Wright graduates who have profitable positions in the aircraft industry.

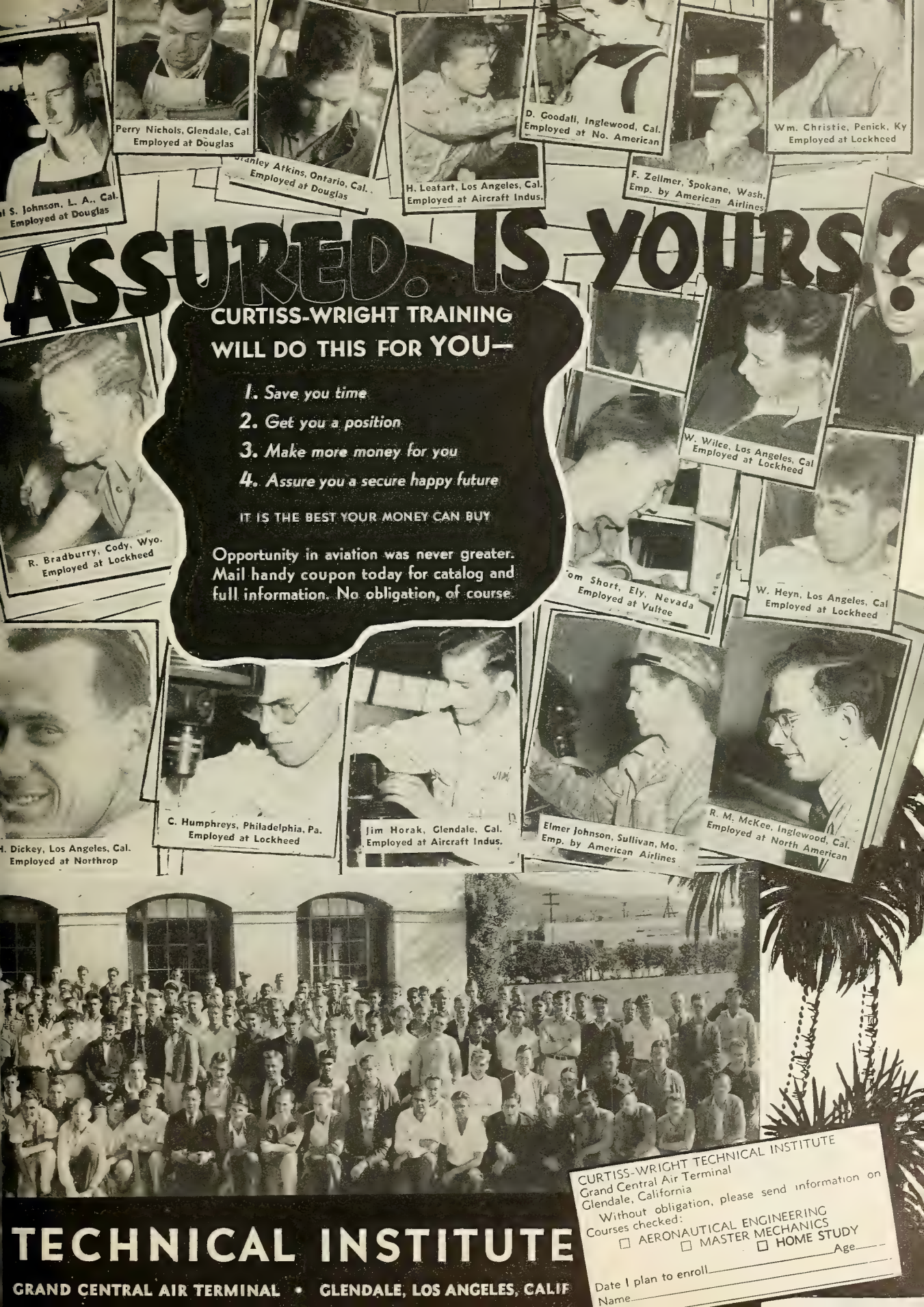
Photo below shows present students at Curtiss-Wright who will also graduate into well paying positions in the industry. Their career is assured. Is yours?

Specializing only in
MASTER MECHANICS
and
AERONAUTICAL
ENGINEERING
*No flying involved.*

**MAJOR C. C. MOSELEY**
**PRESIDENT**

# CURTISS-WRIGHT

**LOCATED IN THE HEART OF THE AIRCRAFT INDUSTR**


Perry Nichols, Glendale, Cal.
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H. Dickey, Los Angeles, Cal.
Employed at Northrop
C. Humphreys, Philadelphia, Pa.
Employed at Lockheed
Jim Horak, Glendale, Cal.
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☐ MASTER MECHANICS
☐ HOME STUDY
Age
Date I plan to enroll
Name




**PUMP ENGINEERING SERVICE CORPORATION**
**12910 Taft Avenue Cleveland Ohio U. S. A.**

# RYAN S-T



## *Pulling* LIKE A MAGNET

Watch a Ryan S-T land at any airport.

As modern as the latest airline transport—fast, sleek and a delight to fly—this airplane has a universal appeal.

Without competition in its field since it was introduced, the new 1937 S-T Series now combines even greater operating and maintenance economy with its outstanding high performance.

The S-T has a cruising speed fully a third faster for comparable horsepower...modern metal construction of polished Alclad...quick acting flaps for slow, short landings...maximum visibility for pilot and passenger...and full equipment without extra charge. Write for complete information today.

***To Distributors and Dealers:*** On the line, the universal appeal of the Ryan S-T is daily demonstrating its ability to actually pull in business for operators at higher than competitive prices. This is profitable business that speaks your language. Ryan has a new Distributor Franchise that is still available in certain territories. Write, or better, wire today for particulars.

**RYAN AERONAUTICAL COMPANY • LINDBERGH FIELD • SAN DIEGO, CALIF.**

# Dallas Aviation School and Air College

LOVE FIELD — *A Government Approved School — Established 1926* — DALLAS, TEXAS

# You Should Know All The Facts

## *You Can't BUY More—Why PAY More?*

### This School *Owns—*

5 Hangars
6 Dormitories
Cafe, capacity 125 students
5 Class rooms
14 Fine Airplanes
30 Motors, 100 to 450 h.p.
$20,000 Machine Shop
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Radio Shop
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2 Aircraft Shops
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3 Stock rooms
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***and many other items that go to make a complete Aviation School.***

A quarter of a million dollar investment—all for our students. ***We have no debts or money obligations.***

All our operations are at Love Field, one of the Nation's finest airports.

### Our Courses

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|---|---|
| **Master Airman and Transport Pilot, 46 weeks** | **$2,795.00** |
| **Special Transport Pilot, 20 weeks** | **1,895.00** |
| **Limited Commercial or Private Pilot, 10 weeks** | **595.00** |
| **Amateur Pilot, 4 weeks** | **350.00** |
| **Advanced Aviation and Mechanics, 40 weeks** | **550.00** |
| **Combined Advanced Aviation and Limited Commercial or Private Pilot, 44 weeks** | **1,045.00** |
| **Combined Advanced Aviation and Amateur Pilot, 44 weeks** | **875.00** |
| **Master Mechanic, 24 weeks** | **325.00** |
| **Combined Master Mechanic and Limited Commercial or Private Pilot, 24 weeks** | **795.00** |
| **Combined Master Mechanic and Amateur Pilot, 24 weeks** | **550.00** |
| **Aircraft Instruments service and repair, 20 weeks** | **325.00** |
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We allow a certain travel allowance with each course, also 5% cash discount

### Our 1937 "Eyes of Texas" Catalog

is available NOW. It is a very complete presentation of the School, our courses in detail and much other valuable and important information. Our Special Offer that is in force now is very attractive and worth your while.

# DALLAS
## AVIATION SCHOOL AND AIR COLLEGE

Aviation Center of the Great Southwest

LOVE FIELD — DALLAS, TEXAS

**DALLAS AVIATION SCHOOL,**
**Love Field, Dallas, Texas.**

Please send me your 1937 "Eyes of Texas" catalog. I am interested in

☐ **FLYING** ☐ **MECHANICS**
(Mark "X" in the square beside your choice.)

NAME .....

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AGE ..... STATE .....

I expect to start a course in Aviation on (date) .....



# Still Supreme

The Fairchild "24" is proud of one outstanding record: *it has established a standard of perfect control and ease of handling,* which—though introduced in 1934—remains still unequalled.

And now, this same "24"—refined and improved—is starting its third year of leadership in popularity among private owners who do their own flying. These are facts—based on statistics.

The reason is quite self-evident. Any "24" owner will gladly tell you. The Fairchild "24" is simply a combination of *all* the fine features demanded of a personal airplane:

- In construction it is endowed with traditional Fairchild quality. Rugged, strong, precision-built—with every detail as perfect as engineering ingenuity can devise.
- In flight—internationally acclaimed for its perfect control; control that permits anyone to fly this ship with ease, assurance and complete confidence.
- In performance — The Fairchild "24" does the things which are most important in a personal ship: it takes off easily from any landing spot—regardless of size or altitude; it climbs steeply, powerfully and with worlds of control; it cruises along at about two miles a minute, carrying three at less than 2½ cents per mile for fuel and oil. And in landing—its phenomenal ability to "hang on" at slowest speeds, sit down and stop in the shortest space, spells safety to even the most inexperienced pilot.

### FEATURES TO LOOK FOR

PAYLOAD 440 lbs.--with an additional 36 lbs. extra equipment allowance.

CLIMB to 10,000 feet in 20 minutes--service ceiling of 16,000 feet with average load.

LANDING RUN of 100 yards--with split-balanced flaps and easy brake control.

BALL BEARINGS throughout give lightest control and virtually eliminate maintenance.

WIDE LANDING GEAR with long oleo stroke prevents any bouncing or ground-looping.

INTERIOR of exceptional comfort with finish and appointments in perfect harmony.

FLIGHT CHARACTERISTICS proclaimed as perfect--and not found in any other airplane.

It is these features which have achieved for the "24" its world-wide reputation as being the finest-flying cabin plane ever designed. It is these features which have made the "24" the leading choice among sportsmen and business men who do their own flying. And it is these same features which you should compare by actual demonstration when you are deciding on a personal ship.

Talk with any Fairchild "24" owner Get his impressions. If pleasure and confidence and peace of mind mean to you what it has meant to him—as scores of letters tell us—then you will be seriously interested in this plane!

For details and a demonstration arrangement write to the Fairchild Aircraft Corporation, Hagerstown, Maryland.

**FAIRCHILD AIRCRAFT CORPORATION** *Hagerstown, Md.*

# The Miracle Circle

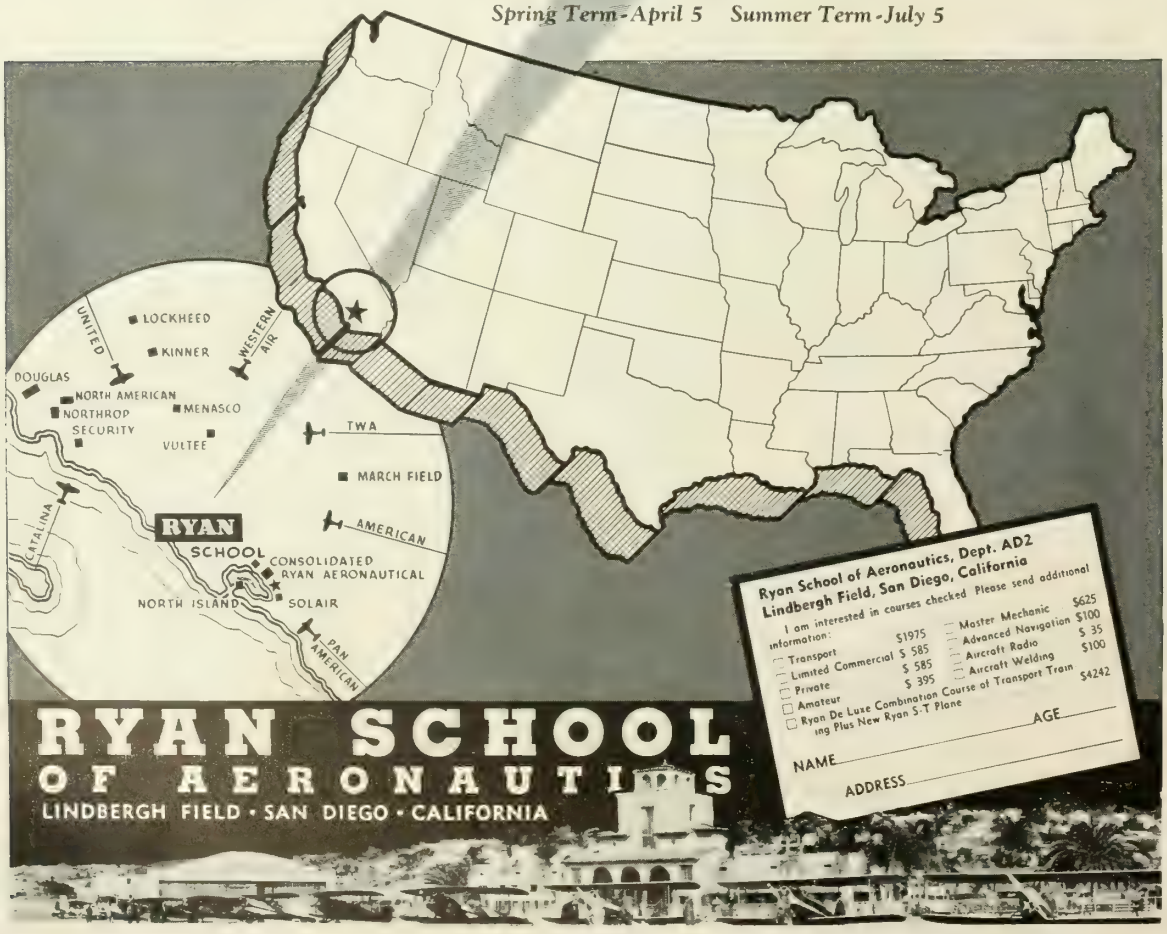
Within a radius of 60 miles, in which the Ryan School of Aeronautics is strategically located, is more aviation activity — more manufacturing — more flying — and more opportunities for success — than anywhere else in the world. Here are located the great factories of Douglas, Consolidated, Lockheed, Menasco, North American, Northrop, Kinner, Vultee, Security, Solair and Ryan Aeronautical Company; the huge Government activities at North Island and March Field; the terminals of American Airlines, Pan American, T. W. A., United, Western Air Express and Wilmington-Catalina and scores of other allied aviation interests.

Ryan training is definitely keyed to this tremendous activity through intimate cooperation with every branch of the industry and the School offers you the only complete flight and mechanical training in this territory that will prepare you for a career, whatever your chosen branch may be.

The high standard and acceptance of Ryan training is shown in the confidence that the industry places in the School which in turn is reflected in the consistent demand for Ryan graduates.

Note the broad selection of courses listed below. Check the one you are most interested in and mail it today. Your greatest opportunity for success lies within the Miracle Circle.

*Spring Term - April 5  Summer Term - July 5*






*1937* blazes a new air trail across the blue Pacific as a corps of U. S. Navy fliers wing their way from the mainland to Pearl Harbor. They fly the first of the new PBY-1 Consolidated long-range air patrol boats.

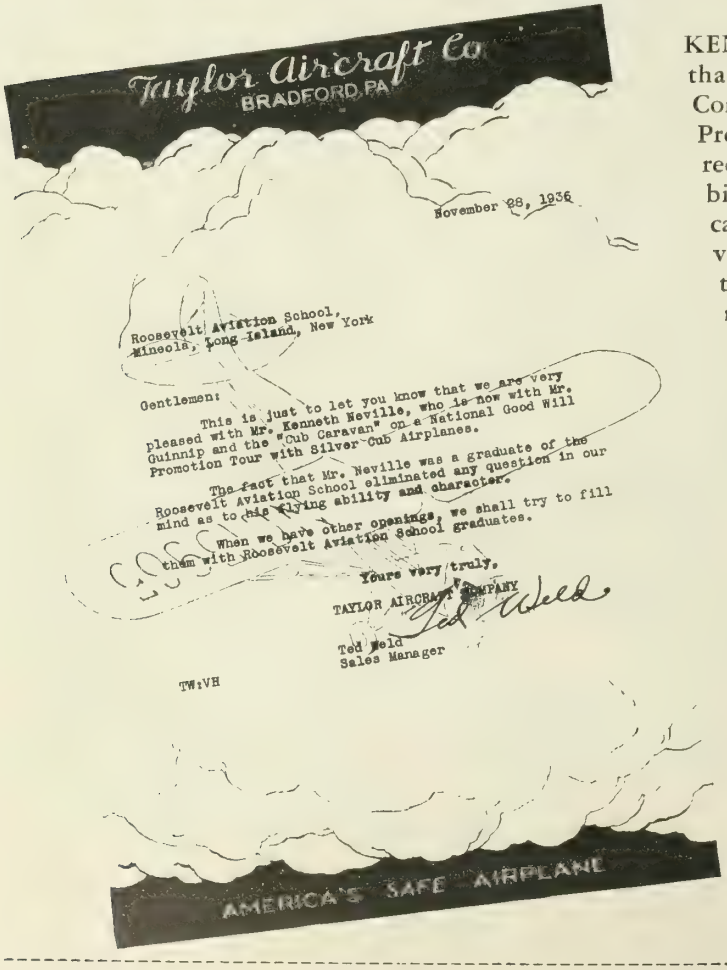
CONSOLIDATED
AIRCRAFT CORPORATION
• ESTABLISHED 1923 •
San Diego, California

# *"When we have other openings, we shall try to fill them with Roosevelt Aviation School graduates"*





The "Cub Caravan" National Good Will Promotion Tour. Left to right: Ellsworth Salisbury, Art Kraft, Ken Guinnip and Kenneth Neville (shown in close-up) Roosevelt Aviation School Master Mechanics and Transport Pilot graduate.



Taylor Aircraft Co
BRADFORD, PA.

November 28, 1936

Roosevelt Aviation School,
Mineola, Long Island, New York

Gentlemen:

This is just to let you know that we are very pleased with Mr. Kenneth Neville, who is now with Mr. Guinnip and the "Cub Caravan" on a National Good Will Promotion Tour with Silver Cub Airplanes.

The fact that Mr. Neville was a graduate of the Roosevelt Aviation School eliminated any question in our mind as to his flying ability and character.

When we have other openings, we shall try to fill them with Roosevelt Aviation School graduates.

Yours very truly,
TAYLOR AIRCRAFT COMPANY
Ted Weld
Ted Weld
Sales Manager

TW:VH

AMERICA'S SAFE AIRPLANE

KENNETH NEVILLE writes: "The fact that I am with The Taylor Aircraft Company on its National Good Will Promotion Tour, ought to be sufficient recommendation to induce other ambitious young men, interested in a career in aviation, to enroll at Roosevelt Aviation School. Without the training I received there, I would not now be in the aviation business, nor would I be enjoying the thrills of this caravan."

# ROOSEVELT
## *Aviation School*

*34 minutes from New York*
**at Mineola, L. I., N. Y.**

ESTABLISHED LEADERSHIP

*Spring Classes Start*
**MARCH 29TH**

*Sign and mail coupon today.*
*"Start Right at Roosevelt"*

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ROOSEVELT AVIATION SCHOOL, Inc., Mineola, Long Island, New York

Without obligating me, send details of course checked below:

Amateur Pilot_____ Private Pilot_____ Limited Commercial Pilot_____ Transport Pilot_____ Elementary Airplane and Engine Mechanics_____ Master Airplane and Engine Mechanics_____ Combination Flight-Mechanics_____

*Name*_____*Age*_____*Street Address*_____*Town*_____*State*_____

A. D. February, 1937


UNITED AIRLINES
now flies DOUGLAS
"Douglas DC-3" fleet...the culmination of "Aircraftsmanship", maintaining regular schedules over UNITED AIR LINES...inaugurates a new high in air travel.
These luxurious sky pullmans... equipped with every proved complement to passenger comfort and operating efficiency...reflect the ultimate in Flight Security.
Pioneer Instruments
PIONEER INSTRUMENT CO., INC · 754 LEXINGTON AVENUE · BROOKLYN, N. Y.
A SUBSIDIARY OF THE BENDIX AVIATION CORPORATION

# DAWN PATROL

## PROVES THEIR TRAINING

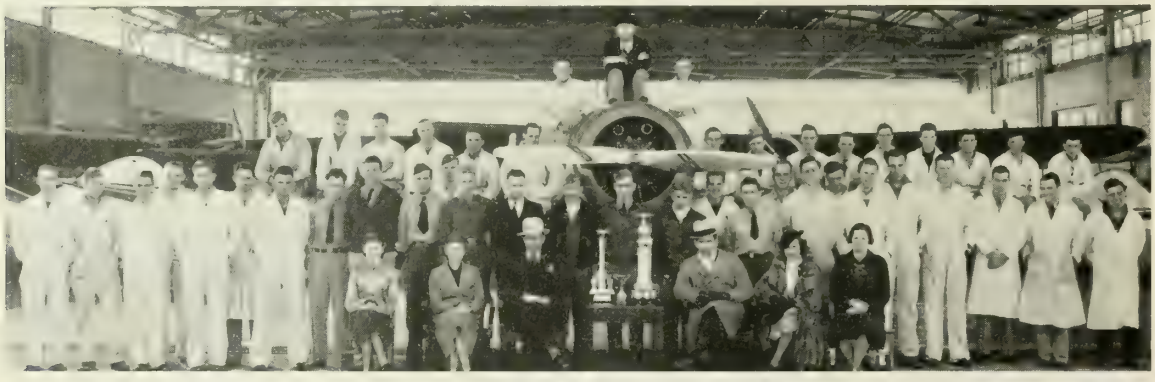


Members of the DAWN PATROL at the 1936 Oklahoma State Air Meet won all the trophies and nineteen of the twenty-four awards, including the Olson Trophy for highest number of points and the Boswell Trophy for most individual points won.

To be a member of the DAWN PATROL is a *distinction individual* to the SPARTAN SCHOOL OF AERONAUTICS. The accomplishments of its members should be a guiding light to those interested in a successful career in Aviation. For what the members of the DAWN PATROL have accomplished while at SPARTAN is an indication of the thorough training, fitting them for definite places in Aviation. *Don't you believe this is the type training to fit you for more than a job in Aviation*—the coupon will bring you the facts!



Laura Tucker a member of the Spartan DAWN PATROL won the highest number of individual points for a woman contestant.



# SPARTAN
## School of Aeronautics

**HOME OF THE 13 DAWN PATROL**

SPARTAN SCHOOL OF AERONAUTICS
P. O. BOX 2649, TULSA, OKLAHOMA

GENTLEMEN: Send me a copy of the NEW 1937 Spartan Catalog and Supplement describing in detail Spartan 3 ★ ★ ★ STAR Courses of Aeronautics, tuition and detailed living expenses:

NAME_____

ADDRESS_____

CITY_____ STATE_____

AGE_____ Any Previous Flying Experience?_____

Check below branch of aeronautics you are most interested in:

- ☐ FLYING
- ☐ MECHANICAL
- ☐ RADIO-INSTRUMENT
- ☐ EXECUTIVE-MANAGEMENT

# FLYING SALES MANAGER MAKES MORE CALLS.... CUTS COSTS *with his* CUB!








MORE and more people are finding the new Cub a valuable business asset. Traveling via Cub is the modern way to make more calls, get more business and cut transportation costs. Read the experience of V. E. Ramsey, sales manager of the Ramsey Package Corporation of Suffolk, Va.:

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VOLUME THIRTY NUMBER TWO



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# Mr. Grey Passes By

**C. G. Grey and Cy Caldwell**

**"You are old, Father William," the young man said,**
**"And your hair has become very white;**
**And yet you incessantly stand on your head—**
**Do you think, at your age, it is right?"**

**"In my youth," Father William replied to his son,**
**"I feared it might injure the brain;**
**But now that I'm perfectly sure I have none,**
**Why, I do it again and again."**

***(From "Alice in Wonderland.")***

● Mr. C. G. Grey, choleric Editor of THE AEROPLANE, London, raises his hand in class and cries to the teacher that a big bad boy has been picking on him. In a letter to Frank A. Tichenor, publisher of AERO DIGEST, he writes:

*Dear Mr. Tichenor:*
*I shall be interested to see whether your sense of fairness will compel you to use up so much of your valuable space as may be necessary to publish the accompanying letter unexpurgated, unedited, and unabbreviated.*
*With all good wishes for the New Year,*
*Believe me,*
*Yours sincerely,*
*C. G. Grey"*

Reaching down into the lower right-hand drawer of his desk, where he usually keeps his sense of fairness, Mr. Tichenor took out the can, sprinkled himself liberally with the beneficent powder, and read the following letter addressed to the Editor of AERO DIGEST:

*"Sir:*
*"Cy Caldwell and I have been friendly enemies for a very long time. As a recognized humorist with his own line he is naturally entitled to a large amount of liberty in dealing with the truth. But when liberty becomes license and distortion of fact becomes deliberate lying I think that something ought to be done about it.*
*"In your issue of December 1936 Cy takes up most of half of one of your valuable pages with a number of statements about me which are definitely untrue and I hope that you will allow me to put your readers right in this matter.*
*"In the first place he says that I used to hate the Huns. His insinuation that I drop my aitches in the way which uneducated Americans believe to be common to all Englishmen does not matter.*
*"The fact is that on August 4, 1914—the day war was declared—I said in* THE AEROPLANE *that we were on the wrong side. Anybody who likes to look up that issue can see it for himself.*
*"I have quoted that statement in* THE AEROPLANE *at various times since that date. And I have always been open in my admiration and liking for the German people.*

Now here I interrupt the flow of Mr. Grey's wrath to answer his letter point by point—and although he accuses me of "distortion of fact that becomes deliberate lying," not only I but the Editor and the Publisher assure you that Mr. Grey's letter is published here exactly as he wrote it—"unexpurgated, unedited, and unabbreviated," in accordance with his desire I merely break it up into sections, the better to answer each section as it clatters from the Grey typewriter.

It seems that Mr. Grey has me on this first point, and I freely admit it, as is my invariable custom when in error. I was not one of Mr. Grey's readers on August 4, 1914, so I couldn't know that on the declaration of war by England, Mr. Grey, an Englishman or Irishman, apparently lined up with the enemy. I say "apparently" after due consideration, for Mr. Grey is such a remarkably inverted fellow that his mental processes are difficult to follow.

Now I apologize for not finding out which side of the war Mr. Grey started on. Although he has apparently been against the French and for the Germans ever since I have been reading him during the past decade, it never occurred to me to imagine that he was that way when his own country was engaged in a death-grapple with its enemy, the Germans.

As to Mr. Grey's published statement in THE AEROPLANE, August 4, 1914, "that we were on the wrong side," which I did not read, and thus took it for granted that he hated the Huns along with his fellow-subjects—I cannot pretend to explain how Mr. Grey got that way. Evidently he wanted England to line up with Germany and attack Belgium and France—he says "we were on the wrong side." But the English people, almost without exception—and those exceptions were mainly professional pacifists or conscientious objectors, and in jail—were not in favor of attacking Belgium. I content myself with asserting that I was not lying about Mr. Grey when I wrote that he hated the Huns during the war, but that I was simply taking it for granted that in wartime Mr. Grey was as full of patriotism as any other Englishman. I beg Mr. Grey's pardon for thus doing him too much honor, and am happy to be able to correct my mis-statement and to announce, once and for all, that according to Mr. Grey not only England but the whole British Empire was on the wrong side in that war.

As Mr. Grey says that my insinuation that he drops his aitches does not matter, I need not comment upon that except to remark that I wrote it only in jest. Mr. Grey does *not* drop his aitches.

But to step aside, and let Mr. Grey enlighten us further—this time about our own country:

*"You Americans know, or ought to know, that the Germans, or descendants of Germans, in the United States are responsible for most of the good work which you do. You have only to look around your best aircraft factories to see the number of German names on the staffs."*

I have no figures showing how many of each nationality are working in American airplane factories. We just lump them all together as people, and we don't care what country they came from, or why, or if they were born here, or even if they like it. If a man's work is good, they keep him; if bad, they fire him, and hire someone else, be he a Russian, Prussian, Italian, or Turk.

As to the Germans being "responsible for most of the good work which we do," that is absurd. The Germans are as good as anybody else, unless they happen to be better—or worse. Mr. Grey continues:

*"So far as General Goering is concerned, I met him first three or four years after the War when he and his friend Loerzer were over here on business and before he went into politics at all. During the last months of the War Loerzer commanded one of the two crack German fighting squadrons while Captain Goering commanded the other, which had been von Richthofen's Squadron. They were very good company and just the type of young men whom we all knew and liked in the British and American fighting squadrons.*
*"A few years later when Goering went into politics I met him in Berlin, and though he had then grown rather more serious, because of his responsibilities, he had hardly altered at all. And those who see a great deal of him in these days say that when he is off duty he is just as good company as he used to be. There is nothing much the matter with a man who collects funny stories about himself, as I know Goering does. Naturally I like meeting him again, and am proud that a man whom I knew in his youth has risen to a high place in History."*

I am grateful to have evoked such fulsome publicity of the charming General Goering—one of whose claims to fame and a place in History is that he helped Herr Hitler engineer the *coup* which resulted in the murder of several other Germans who were personally, socially, or politically objectionable to *Der Fuehrer*. These two paragraphs above sprang to life in response to the following statement



in my December notes: "Mr. Grey lets it out to the Gods and ourselves why he is so pro-German: General Goering actually *spoke to him.* Yes sir, General Goering, the cultured Aryan, spoke to Mr. Grey, who was simply dying to be spoken to, or in fact noticed at all at a German aviation meeting."

That's what got Mr. Grey all het up—he couldn't bear to have it thought that he hadn't been exposed to the peculiar German *kultur* for years back, and was now stuffed to the neck with it. Very well, then, I cheerfully accept Mr. Grey's correction of my statement and now gladly print his boast that he has been Germanized for years, and nothing can be done about it—except possibly by the English airplane manufacturers who advertise in his trade paper, and who may object to having English aircraft advertised by a pro-German—or a pro-anything-else except a pro-Englishman, which it seems to me that the editor of an English trade paper should be.

Incidentally, I have nothing against General Goering personally—I don't even know the man. But I have a hearty and healthy dislike for everything political that he stands for; yet I do not hate Germans or even dislike them; and for the German people as a whole I have only sympathy and pity—for they obviously are headed like sheep toward wholesale slaughter, about which nothing probably can be done. Nor can anything be done about General Goering and his fatal charm which has so overwhelmed susceptible Mr. Grey. One of the most charming fellows I ever met is now in jail for forgery. But to return to Mr. Grey and his letter:

> *"In spite of his experience as a war pilot Cy seems to have forgotten that during the War the only place where one could openly recognize the good qualities of the Germans, both as a people and as soldiers, was with the British Army on active service,—and, I imagine, with the American Army. I hardly ever came across a fighting man who felt any personal animosity against the Germans. Most of our men admired them immensely, especially the flying people."*

Now, here, oddly enough, I find Cousin Grey in agreement with me—which gives me the fleeting and disturbing thought that I may be wrong, for Charles is so seldom right. But on serious consideration, I know him to be right in this one paragraph—the only paragraph in his letter which is right side up.

I have forgotten many things about the war, but not my admiration for the unsurpassed courage and endurance of the common German soldier. I admire the German pilots, too, but theirs was the easier, because the cleaner and more sporting job like my own war job with the English. But that common, largely ignorant German private, who in his shoddy grey uniform bore the brunt of the war upon his tired shoulders—for that stolid, patient, fearful, daring, despairing, hoping fragment of humanity lost in mud and horror, I have nothing but the profoundest admiration, the most whole-hearted sympathy and understanding.

Perhaps I am somewhat to blame for misleading Cousin Grey with too careless use of the word "Hun," for in his next paragraph of complaint, he writes:

> *"Just why Cy should during the past few years have become so violently anti-German is difficult to understand. One can only assume that he is moved by antagonism to anything which pertains to that spiritual state which is called either Fascism or National Socialism. Your readers may be confirmed in this belief by the fact that when he has finished misrepresenting my views he proceeds to jeer at the Italians and the Germans for supporting the Spanish Nationalists."*

Good for dear old Cousin Charles!—He has almost read me aright for once—almost, but not quite. I am anti-Nazi, but not anti-German; anti-Fascist, not anti-Italian; anti-Communist, not anti-Russian; and anti-Grey ideas, not anti-Grey, the charming soul. I never fight people; I fight the ideas that dominate them; I fight the thing they represent, not the men. Men are relatively unimportant—they die and are done with soon enough. Ideas are important, for they live and effect generations yet unborn. But to return to Mr. Grey:

> *"He calls General Franco's forces rebels, despite the fact that they have a better right to call themselves the Spanish Government than have the Reds, considering that after the last Spanish Election the people whom General Franco represents held 43% of the seats in the Spanish Cortes and that the other 57% was divided among the Communists, Syndicalists and Anarchists, who call themselves the Spanish Government by virtue of having bumped off all the Opposition on whom they could lay their hands."*

Well now, I submit that even by Mr. Grey's own statement this odd mixture of Communists, Syndicalists, and Anarchists must be considered the "Spanish Government," for they all got together and, according to Mr. Grey, form 57%—while "the people whom General Franco represents," whoever they are, only amount to 43%. So the majority rules, as it is supposed to do in a republic, even a Spanish republic. Evidently Mr. Grey and I agree that the Loyalist government, whether it be Red, pink, or black-and-tan, is truly the recognized Spanish Government, while Franco and his gang are the rebels. At least England and the whole British Empire recognizes that government as the Spanish Government, as does the United States. But who are we, the British Empire, the United States, and even myself, against the non-recognizing Mr. Grey?

As to Mr. Grey's charge that the Loyalist gang bumped off some of the rebel gang, thus gaining control, please don't expect me to take sides on that matter. I am absolutely neutral on the Spanish question. I am for the bulls; I always have been. No matter what political party was in power in Spain, the bulls were always out of luck—mere harried Republicans in a bull-ring infested with Democratic matadors. Now that the Spaniards are killing each other, the bulls are getting a vacation. Concluding, the keen-eyed Mr. Grey, who notices everything except what is obviously sound and factual:

> *"I notice also that Cy refrains from jeering at the French and Russians for sending men and machines to fight for the Communists;—whom he calls Loyalists. We must therefore assume that he sympathizes with them.*
>
> *Yours truly,*
>
> *C. G. Grey."*

We must assume no such thing—unless we are like Cousin Charles, who is willing to assume anything, so long as it probably isn't true. What I wrote was, "As for the other side of the Spanish argument, there is France, Left-wing itself, and Russia, dedicated to the peace of the whole cock-eyed world (*after* the World Revolution) both sending the Spanish Loyalists some nice shiny French and Russian warplanes in assorted sizes, complete with pilots, so they could do battle with the nice shiny warplanes contributed to the Fascist rebel side by the two leading Fascist countries of Europe." Yet Mr. Grey, after reading

(*Continued on page* 88)

# EDITORIALS

★

**"I have seen the fighting aircraft of all the major countries, and I've seen the factories and plants where great droves of new ships are to be turned out like fury when the order comes. It's to be a race with the world at stake when—the air war comes. The nations which turn out the greatest number of the best ships are going to have a head start."**
***Al Williams, Aviation Manager, Gulf Refining Co.***

## Complete The Military Program

Offensive notions harbored by belligerent or ambitious nations can be thoroughly checked by modern and adequate defense plans. This is particularly true as to an aerial defense, for nations powerful in the air today are generally powerful enough to thwart attempts against their nationalism.

Last year our national budget allotted $887,881,080 for national defense by the Army and Navy for war military activities. Actual 1938 fiscal estimates for strictly military purposes total $980,763,000 or a jump of approximately $100,000,000. This is to allow for increased enlisted strength, more aircraft and construction of warships.

Total money requested for the Bureau of Aeronautics is $49,500,000, a gain of $10,000,000; $27,186,000 is earmarked for new aircraft which is $6,206,000 more than last year. The Air Corps asked for $60,500,000 (increase of $1,101,286) with which the army proposes to buy 530 new planes. Of these 441 are for the regular Army and 81 for the National Guard. In addition some $3,588,000 is needed to equip planes with up-to-date radio, machine guns, and other accessories. Thus, the total asked for military aviation is $113,588,000.

President Roosevelt must be fully cognizant of the increasing importance of the airplane as a prime means of defense. It is hoped that the members of the Appropriations Committees will take note of this when the time comes to consider budget figures. There are some items which, by law, must be provided for. These include the planes called for in the 1936 Army bill and the Naval expansion program.

Development and design expenditures may not be included in the above figures, but it will be well for Congress to keep in mind that new aircraft are ineffective unless they embody the latest advancements in the art. If budget figures are to be pared, money can be lopped off projects which do not affect the foundation of the country's national defense.

## "Poor Little Rich Girl"

Everyone present at the Round Table Conference of the Institute of the Aeronautical Sciences and the subsequent showing of motion picture films of the aeronautical research facilities in England, France, Germany and Italy must have been impressed to see the immense testing laboratories of Germany and Italy. The size and variety of equipment, modern buildings, large grounds, the richness of the apparatus seen on the screen were indisputable evidence of the sums of money spent on these facilities.

Considering the national wealth and resources of these nations in comparison to our own, it is sad to see the difference in our antiquated research facilities. Need we point out in this Anno Domini 1937 that aviation is the last expression of civilization; that the future growth of the country, and particularly the speed of this growth is irrevocably connected with aviation? To accept this view, if we are to face reality, we must admit it is we who are wrong and not the fifty million Frenchmen, fifty million Germans and fifty million Italians.

For many years we were the only ones to have the variable density tunnel, full scale tunnel, high-speed tunnel, engine laboratories, etc., etc. Now there are bigger and better tunnels, and bigger and better laboratories, but they are not ours. They are available in financially embarrassed countries who appreciate their need.

Our research facilities should be in proportion to the country's needs and wealth.

## A Static Regime

Eugene Vidal seems determined to stick as Director of Air Commerce, come what may. Quite annoyed over published reports in the daily chronicles of his impending resignation, he had a formal statement prepared for the gentlemen of the press. In effect, he claimed that these reports were "without foundation,' and that when he entered public service, he did so "with the purpose of carrying out a definite program for the advancement of civil aeronautics." That program, he said, has not been completed (how true!) so the assumption is that Mr. Vidal hopes to hang around till it is—whenever that may be.

We've yet to learn what this definite program Mr. Vidal talks about really is. It must be a deep mystery, because anything that the Bureau has done since Vidal ascended the throne has hardly advanced aviation. Progress made was the result of industry's initiative, not Mr. Vidal's.

Is it possible Vidal is referring to his light airplane idea—the one which threw a monkey wrench into the manufacturer's machinery? Or, maybe he's talking about his airway system—the one which a Senatorial investigating committee found was responsible for the crash of at least one airliner, and possibly another, together with the loss of passengers.

If that is Vidal's program for the advancement of the industry, and he's not going to get out before it is completed, we are in for a nice static time. Vidal is not doing his job and every day he is in office is just another day in which real progress is retarded.

A kind friend (if any) ought to tip him off!

## Safety of Air Transportation

The Bureau of Air Commerce babbles incoherently about a "foolproof" safe airplane, yet any vehicle of transportation is only as safe as its operator, regardless of what devices are installed to counteract inexperienced or foolhardy control. That goes for an airplane, automobile, or bicycle.

As usual, the Department pops off without "looking at the record." Its own reports show that in 1936 one make of plane, Stinson Reliants, operated by private owners, flew more than 9,000,000 miles with but one fatal accident. In that case the pilot stunted too close to the ground—always a tricky and useless maneuver which sometimes results disastrously.

Such a record is sufficient proof that a modern plane is safe—far safer than the modern automobile in traffic.

# NATIONAL AVIATION SHOW

## Grand Central Palace, New York, January 28 to February 6

● New York City plays host to the industry beginning January 28 when the National Aviation Show opens at the Grand Central Palace for an extended run until February 6. Sponsored by Aviators' Post #743 of the American Legion, and managed by Gus Parsons, this event, the first of its kind in the metropolis since 1930, promises to become an annual affair of outstanding success. Space reservations have been taken for 33 airplanes and by more than 100 manufacturers of engines, accessories and other aeronautical products.

Efforts to attract the public center about the arrangements made by the show publicity committee, headed by Sam Taylor Moore, which has completed plans for a mock aerial attack on the city at night, a massed flight of private aircraft over the metropolitan area, and numerous other military and civil maneuvers designed to focus attention on the air show.

Three floors of the Palace will be used to house the exhibits. On the first floor will be the products of twenty-nine concerns including Argonaut Aircraft Corp., Bellanca Aircraft Corp., Jones School, Monocoupe Corp., Beech Aircraft Corp., Cessna Aircraft Corp., Fairchild Aircraft Corp., Fleetwings, Inc., Luscombe Airplane Development Corp., Ryan Aeronautical Corp., Seversky Aircraft Corp., Stinson Aircraft Corp., and Waco Aircraft Co., all of which will display one or more airplanes, some mounted on floats. Other aircraft will be shown on the second floor including an Aeronca, Arrow Sport, Keane, Rearwin Sportster, Porterfield, Taylorcraft, Taylor Cub, Al Williams' Grumman, a Bleriot (both suspended), and two military types. Among the fifty-seven exhibitors on this floor will be AERO DIGEST which has a registration service of exhibitors' personnel and which is providing stenographic and information service to members of the industry. The third floor will house the duPont Albatross Soarer, the Roadable Autogiro, almost fifty exhibitions, as well as a motion picture theatre and headquarters for the working press.

Among the unusual features will be a duplication of the airline traffic control system at Newark Airport. A miniature of the Newark control tower will be shown with the actual operations transmitted directly from the airport. A microphone in the show will bring the voices of the dispatchers as they direct take-offs and landings of the transport planes arriving and departing at frequent intervals at Newark.

Another advance in commercial flying will be seen in a demonstration of the radio-meteorgraph, a new device for investigating weather at altitudes without the necessity of sending up an airplane equipped with a meteorological instruments. The radio-meteorograph consists of a small balloon carrying with it an automatic radio unit which, at 10-second intervals, report the barometric pressure, the temperature and altitude, from the earth to 12 miles in the stratosphere. This automatic transmitter weighs less than 1 lb. and operates continuously for 12 hours if necessary, sending its report by code. Another attraction will be moving pictures of the latest aeronautic research laboratories and wind tunnels of principal European nations.

A 30 × 20 ft. map of the United States especially made for airmen by the U. S. Coast & Geodetic Survey will occupy a prominent position. Aimed to serve cross-country fliers, the map shows rivers and lakes, cities, railroads, principal Federal and State highways with elevations of hills and mountains clearly indicated.

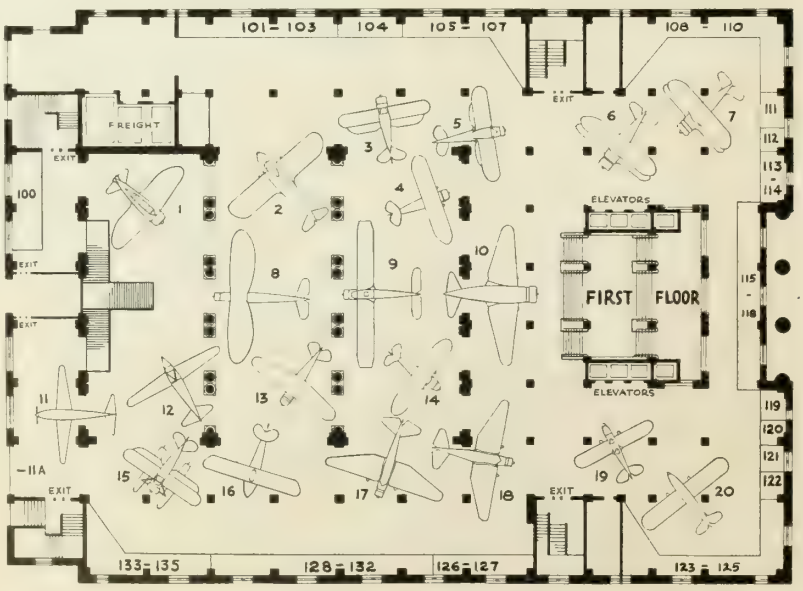
Two contributions in the experimental field giving promise of future usefulness will be shown. One is the Edo attachable amphibious gear (described in this issue of AERO DIGEST) by which conventional land planes may be transformed into amphibions. The other is the Roadable Autogiro built by the Autogiro Company of America.

The U. S. Army exhibit will feature a Boeing pursuit in addition to which the story of progress in equipment will be told by comparative displays of old and new type propellers, old and new type engines, and other interesting details. The Navy exhibit will feature a Grumman fighting plane of the type used on aircraft carriers. The 27th Div. Aviation, New York National Guard will be represented by a comprehensive exhibit featuring the varied services and equipment of observation squadrons — bomb racks, dummy bombs, machine guns, Fairchild machine gun cameras, Fairchild aerial camera and demonstration of how mosaic air maps are made as well as a Douglas O-46-A. There will be daily demonstrations of parachute packing.

The *Early Birds* exhibit will feature a Bleriot looping monoplane from the Roosevelt Field Museum. An unusual feature of the air transport display will be the Northrop Gamma used by Transcontinental & Western Air for stratosphere work; Tommy Tomlinson who has been conducting the stratosphere investigations for many months will explain the apparatus used.

Various organizations and associations have set aside periods during the show for annual or special gatherings or meetings. Among these are the Institute of the Aeronautical Science on Jan. 27-29; National Association of State Aviation Officials, Jan. 27-28; Sportsman Pilots Association, Jan. 30; Aviation Section, SAE; Private Fliers' Association; State Aviation Associations of New York and New Jersey; Air Line Pilots Association; *Early Birds;* Army Reserve Association;

(*Continued on page* 89)



# List of Exhibits at the Air Show

## AIRPLANE EXHIBITS

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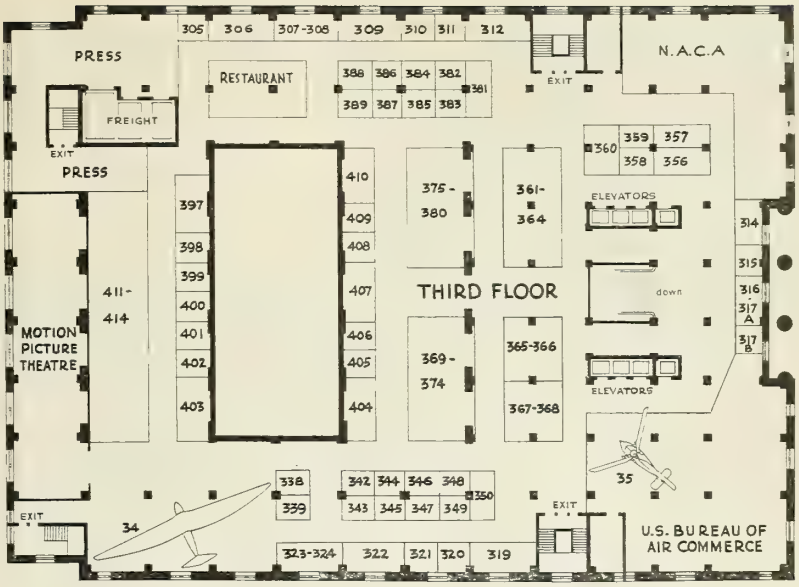
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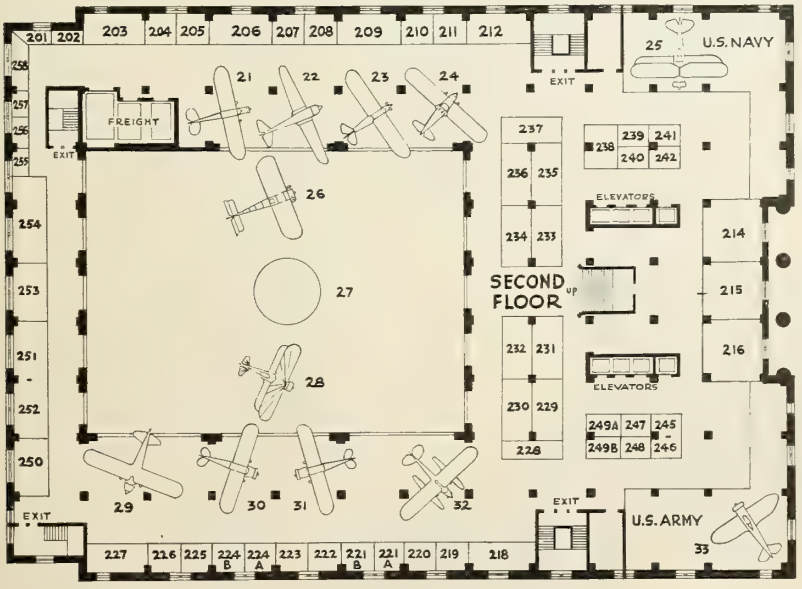
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# SOVIET AVIATION TODAY (Part 1)



*ANT-25 which made a 5825-mile non-stop flight*

**On the eve of the 20th anniversary of Soviet aviation, AERO DIGEST presents the most comprehensive study of the subject ever published outside the U.S.S.R. Part I is a report of the current status of aeronautics in that country, gives a historical resume, details advances and shortcomings of recent years, describes constructional features and performances of a few airplanes which distinguished themselves during the past year. It lists other outstanding aircraft, takes up problems of passenger, mail and express transport, discusses capital construction and equipment, outlines the special applications of aircraft in industry and agriculture, and concludes with a statement of prevailing trends. Part II will deal with a more extended digest of aircraft and aircraft engine types, their characteristics and performances, the administration of both civil and military aviation, training of pilots. It will also report the work of the mass organization of *Osoviakhim*, on international records and other notable work of Soviet airmen.**

● Russia's exact position among world air powers is not yet definitely known. What is known is that this country has a large air force, perhaps the most potent in Europe. Its position is all the more remarkable if we recall that only a few years ago the Soviet Union embarked upon its aviation history with a few bedraggled flying "coffins." The total output of planes and engines in the pre-war Russit was not more than 20 a month, and up to 1916 inclusive Russia built 2050 planes and 578 engines. Built under foreign licenses, the machines were 70% French.

Despite an ample supply of raw materials the production of aircraft languished. Engine building was in an even worse condition. The use of special steel and light metals was virtually unknown in the old Russia.

At the outset of the World War, the Imperial Air Force possessed 16 types of planes, only two of them of Russian origin, while of the 9 types of engines only one was Russian. To make matters worse, during the war France ceased deliveries to Russia because she needed her entire output. Besides transport of goods was difficult.

On June 28, 1918, the air force was taken over by the Soviet Republic and Nikolai Lenin took charge of the reorganization and laying the groundwork for new development. In the beginning the work advanced slowly due to shortage of materials and trained men.

Subsequently, Prof. Zhukovsky founded in Moscow the Central Aero-Hydrodynamic Institute which today, together with the Scientific Motor Engine Institute, supervises all scientific-technical research and work of Soviet aeronautics. At that early stage 3,000,000 roubles were appropriated for the purchase of foreign ships and engines. A great part in making the young republic airminded, in providing training and financial assistance was played by Osoviakhim, a mass organization with millions of members.

Soviet aviation began to show first signs of reorganization and re-equipment in 1922 by purchasing some aircraft abroad. With moderate domestic activity, it became possible by 1928 to formulate a definite program of aeronautical expansion in the First Five-Year Plan. Factories were constructed; by 1930 the manufacture of planes and engines reached a point which made possible



*The three-place twin-engined KAI-3, full cantilever low wing monoplane powered by Russian-built M-11 engines*

PEYTON M. MAGRUDER and LUCIEN ZACHAROFF

**Although information concerning Soviet aviation is difficult to obtain, the authors have compiled a comprehensive article dealing with aviation in the U.S.S.R. at the present time. All accompanying photographs courtesy of "Sovfoto"**



*Four-engined bombers flying over Red Square*

equipment of most military units with craft of Soviet construction. In 1935 about 4000 planes and 20,000 engines a year were being built by some ten large aircraft plants and four aircraft engine enterprises.

From 1000 ships in 1931, the first-line strength of the military air force expanded to what conservative foreign experts placed at 3000 craft at the beginning of 1936.

As for civil aviation, British and French observers after inspecting Soviet exhibits at the recent show in Paris had nothing but praise. The ANT-35, for instance, was publicized in *Flight* to show "that Russia has been making real solid progress technically during the last couple of years."

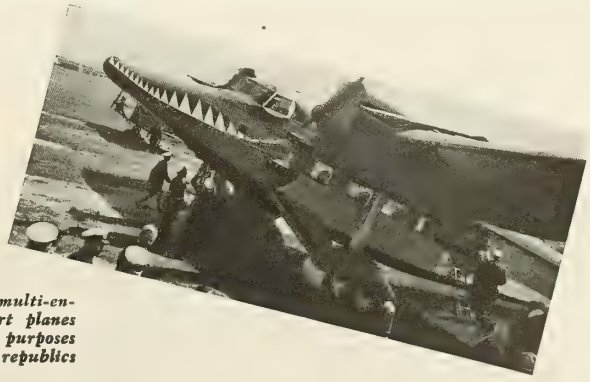
In creating ANT-35, in accordance with the designs of Prof. A. N. Tupoleff, the Central Hydro-Aerodynamic Institute sought to provide Soviet aviation with a fast passenger transport—and its success was proven on Sept. 15, 1936. On that date, with Pilot Gromoff at the controls, the ANT-35, with 7 passengers made a 787-mile round-trip flight between Moscow and Leningrad in 3 hours 38 minutes.

Replacing the more antiquated and less confortable models, this 12-seater incorporates the latest findings of aeronautical science in regard to safety and other features. Cabin accommodations are roomy, with a gangway down the center. Two Russian radial, air-cooled M-85 engines, rated at 850 hp each, give the machine a maximum speed of 268 mph, and a range of 1250 miles. These engines are enclosed in long-chord cowlings carrying controllable flaps on their trailing edges, and are equipped with three-bladed controllable-pitch propellers. With maximum load, the ANT-35 can sustain flight on one engine. Its gross weight is 14,500 lbs., wing span 68 ft. 3 in., and wing area 625 sq. ft. ANT-35 is equipped with dual controls, instruments for night and blind flying under any meteorological conditions, and an automatic pilot.

Another machine that attracted attention is the ANT-25, which last summer made a record non-stop flight. Flying by instruments in fog and sleet over the Moscow-Arctic Ocean-Kamchatka-Nikolaevsk-on-the-Amur route, the crew of three remained aloft for 56 hours 20 minutes and covered 5825 miles.

Of all-metal construction, the ANT-25 is a single-engined monoplane with a length of 44 ft.; height of 18 ft.; wing area 946.8 sq. ft.; empty weight 9240 lbs.; wing loading, 26.24 lbs./sq. ft.; power loading, 26.4 lbs./hp; maximum speed 149 mph; duration, 100 hours.

Other civil aircraft types produced in the Soviet Union and to be described in Part II of this article are ANT-9 used on the Moscow-Irkutsk line, the longest commercial route in the country; ANT-14, a five-engined monoplane; ANT-20, the largest land plane in the world; AIR-5, a four-place cabin monoplane; AIR-6, a smaller version of the AIR-5; AIR-7, a two-seat high-performance monoplane; AIR-8 and AIR-9, light training craft; AIR-10 and AIR-12, light, two-seat, open cockpit, low-wing monoplanes, the latter particularly designed for long non-stop work; K-5, a single-engined, ten-seat commercial plane,



*One of the large multi-engined Russian transport planes used for propaganda purposes throughout the Soviet republics*




*A four-engined ANT-6 bomber many of which are now serving in the Soviet Air Force*

and K-6, a single-engined, mail-carrying job. There are other types, but the craft enumerated above are representative.

The Scientific Research Institute of the Civil Air Fleet has manufactured an airplane made entirely of welded stainless steel-tube and sheet. Designed by A. Putiloff, it is a five-seat cabin monoplane called the Stal-2.

The U.S.S.R. territory is huge and as yet insufficiently provided with railroads. A number of industrially significant territories—parts of Siberia, Far East, Central Asia and Far North—are being developed at a fast tempo and require adequate transport and communication facilities.

However, even in the European part of the Soviet Union where a network of railways links industrial and administrative centers, aviation has already become a necessity for speeding up transportation. In many parts of the country it is the only means of travel.

Great expanses of forest land must be patroled from the air; map-making in such a tremendous country is done most effectively from the air. Aviation has become Russia's most efficient medium for destroying malaria breeding havens in the Caucasus, Central Asia and Transcaucasia; infected regions are dusted from the air. Agricultural insect pests, especially the locust, are destroyed from the air.

With a small subsidy from the government it is possible to offer air passenger transport at rates but little higher than railroad fare. Considering the great number of people traveling in the U.S. S.R., it is not difficult to foresee the time when even without a subsidy the low air rates will be a paying proposition.

In order to present a clear picture of the current level of Soviet civil aviation, its development, shortcomings and perspectives, its principal trends are analyzed below.

The network of airlines is considerable. In 1936—exclusive of the lines of the North Sea Administration and of parallel routes—the length of airlines was from 32,310 to 33,000 miles of national significance and about 15,500 miles of local routes. Thus, the length of Soviet airlines exceeds that of all European countries and is approaching the United States total.

Virtually the entire territory is embraced by this network which extends not only to the European part but also to Siberia, Far East, Central Asia and Kazakhstan. Thanks to the assimilation of many complex and difficult routes, the most outlying sections of the country boast of rapid and steady communication by air.

Only a short time ago a flight from Moscow to the Far East (over a route of about 5000 miles) was attended with extraordinary obstacles. Each flight required much preliminary activity and was regarded an outstanding event. Today mail and passenger planes take off daily from the Moscow Airdrome, carrying passengers as far as Novosibirsk and mail to Khabarovsk and Vladivostok. The Moscow-Khabarovsk-Vladivostok line is now commonplace.

From Irkutsk planes also take off daily for Yakutsk. Covering more than 1240 miles over the Siberian *taiga* under difficult conditions, these planes link the parts of distant Yakutian Republic not only with the regional center but with the metropolitan centers of the entire Union.

The development of airlines naturally leads to the expansion of volume of transport aviation's work. The growth in the number of passengers and quantity of mail carried is illustrated by the following figures: In 1934 civil aviation accounted for the transport of 97,400 persons, (of which number state and local lines carried 72,700) and of 3853 tons of mail. In 1935 corresponding figures for passengers were 127,500 and 101,300, and for mail 5875 tons.

In 1936 Soviet airlines, according to still incompletely verified estimates, transported 170,000 passengers over routes of state significance alone, the grand total for the nation reaching more than 200,000 persons; and at least 7500 tons of mail. The last-named figure would place the U.S.S.R. far ahead of any European country and make it a rival for the U. S.

While concentrating on its network of airlines, the Civil Air Fleet fell behind in its program of capital construction and technical equipment of these lines. As a result, the communications system is weak in spots, airdrome construction in many places does not provide the necessary comforts for passengers, and only a small number of regular air routes are equipped for night flying. All this substantially affects the regularity of flights, and uninterrupted operation, and conse-





*Above: K-5, the first all-Russian transport. Left: a hospital plane designed by A. T. Lingart, carrying stretchers under its lower wings*



quently tells on the intensity and quality of the work.

It must also be noted that the Air Fleet has been tardy in the matter of re-equipping passenger and mail aircraft and hence is comparatively backward in the principal quality index-speed. This low state of speed and equipment of the airlines for night flying lowers the effectiveness of Soviet civil aviation, and it is especially felt on the airlines running parallel to various railways.

Soviet railroad transport has been appreciably improved in all aspects, including speed on longer hauls. Therefore to gain a substantial advantage over the railroads, aviation officials feel that a level of performance must be reached on all basic air routes, not exceeding 2000 miles, wherein passengers can be transported from the starting point to their destination within a day, and on the Far Eastern Moscow-Khabarovsk route in no more than 2½ days. As yet this is an unattained ideal because most of the planes in this service do not operate at night.

One of the principal tasks before the Civil Air Fleet is to furnish the airways with the best type of equipment and to replace those in use with more perfected craft. When the results of 1936 are definitely ascertained, it may turn out to be a decisive year in this respect because

*A 6-place cabin transport, the LK-1, which has accommodations for five passengers*

the Government assigned more than 300,000,000 roubles for capital investments last year. This gave the airways an opportunity to expand capital construction, to improve or replace airdromes and parts thereof, and particularly to launch a program of widespread equipment of the basic routes with means of communication.

In 1936 a number of up-to-date types of aircraft which ultimately will replace all antiquated models were produced. This offers a definite promise of upward qualitative and quantitative swing in passenger transport in the near future.

In mail transportation Soviet aviation has registered achievements which clinched its world supremacy in 1936, although speeds are rather low. With the introduction of express mail aircraft, delivery of mail over the far-flung areas of the U.S.S.R. will be speeded up. One of the Civil Air Fleet's fundamental goals is to establish itself as a basic mail carrier.

Up to now there has been a relatively limited utilization in the Soviet Union of aviation for newspaper delivery, although this is regarded as an important and valuable service because the press has for years been a most powerful organizer of and stimulus to developments in industry and agriculture. At present, small shipments of newspapers are sent by plane to various large cities; yet, the leading Moscow newspapers do not reach even the largest cities of outlying Soviet republics and provinces until many days after publication. With proper application of even current facilities, central newspapers could be read in distant cities the day they were issued.

Soviet practice has applied the airplane for transporting large commercial loads. In 1935, Soviet airlines carried 9950 tons of express. For 1936 the plan called for more than 16,000 tons, and judging by the performance during the first nine months of the year, the figure has been surpassed. In cargo transport Soviet aviation has overtaken and surpassed all countries, including the United States and Canada.

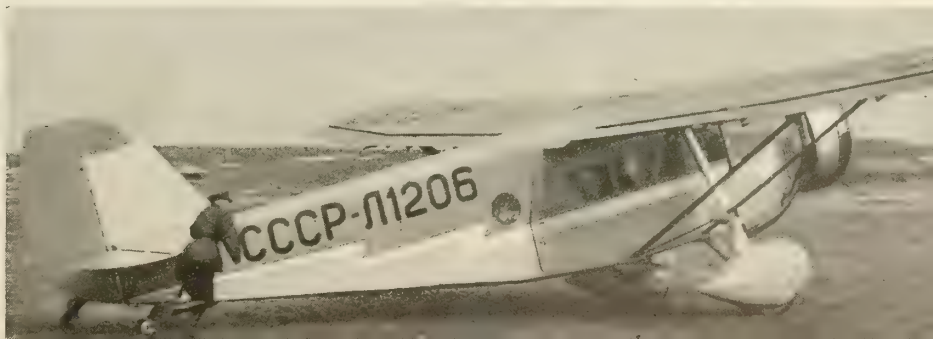
There are in the U.S.S.R. airlines exclusively devoted to the transport of express. Sulphur produced in the Kara-Kum steppes of Turkmenia is brought to Ashkhabad mainly by plane. Large quantities of babbitt are flown from the factories where it is produced directly to the manufacturing plants which use it. Considerable cargo is carried by air in Eastern Siberia and the Far East. In the first-named area planes transport furs, gold and other valuable metals, and materials, various equipment and even food. Research into future demands of Eastern Siberia on aviation reveals that in this part of the country alone in the next few years air express transport may reach 40,000,000 ton-kilometers.

In other than outlying sections, express transport finds application when other forms of transportation are not available. A considerable flow of air express is evident in the European part, and even on airlines which parallel railroads.

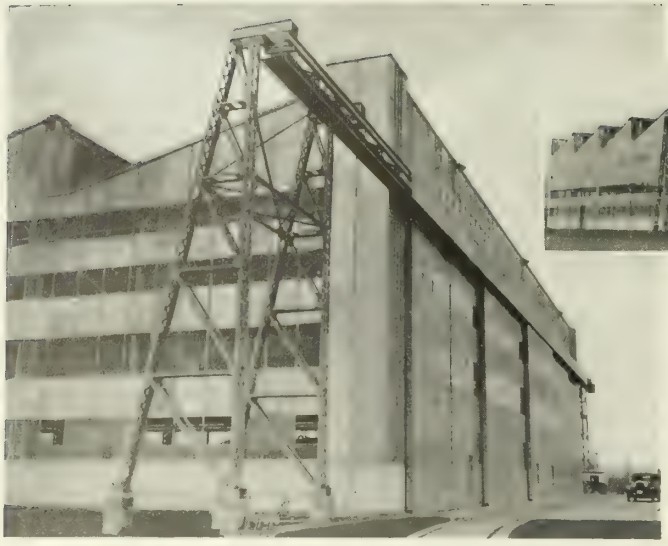
Experience to date makes it clear that the growing socialist economy will continue to impose a correspondingly growing demand on air cargo transport. This will undoubtedly lead to the development of special freight-carrying types of aircraft and special freight routes which in the next few years will appreciably expand the volume of the Air Fleet's work.

(*Continued on page* 48)






***Above: The twin-engined CKB-26 which holds a number of world altitude records. Right: The Stal-3, an all-metal monoplane of welded steel***





# Specially Planned Modern Building for Final Assembly

● Built to accommodate the largest type of landplane or seaplane, as exemplified by the YB-17 Bomber and the flying boats for Pan American Airways, the new $250,000 assembly building recently placed in service by Boeing Aircraft Co. at Seattle, has increased the company's floor area by about 60,000 sq. ft. and brought the total available area to more than 408,000 sq. ft.

Designed and constructed by The Austin Co., the 204 × 304 ft. steel building is at present devoted entirely to assembly operations on a fleet of four-engined bombers for the U. S. Army Air Corps. Work carried on there includes final assembly of the component parts of the planes—wings, control surfaces, landing gear and tail wheels—and the installation of flight controls; electrical equipment and wiring; conduit, fuel and oil tubing; and nacelles and cowlings. Although the building is complete in itself, it was designed with a view to possible future expansion in any or all of three directions. In this event, the first probable additional unit to be constructed would provide for sub-assembly operations alongside the main assembly floor.

The building is located on a 28-acre site purchased by the company and is adjacent to Boeing Field, a comparatively short distance from the main factory. The Duwamish waterway runs from the rear of the site directly to the rear of the main factory allowing large parts (such as fuselages) that would be difficult to transport otherwise to be readily loaded onto barges at the main plant and towed up the waterway to the new building. At the rear of the 28-acre tract, a 50 × 75 ft. dock has been erected for this purpose. A railroad spur leading directly onto a 100 × 209 ft. concrete apron at the front of the building enables the shipment, by freight, of materials and parts directly to the plant. Trucking will provide the major means of transportation between the original plant and Plant No. 2 as the new unit is now designated.

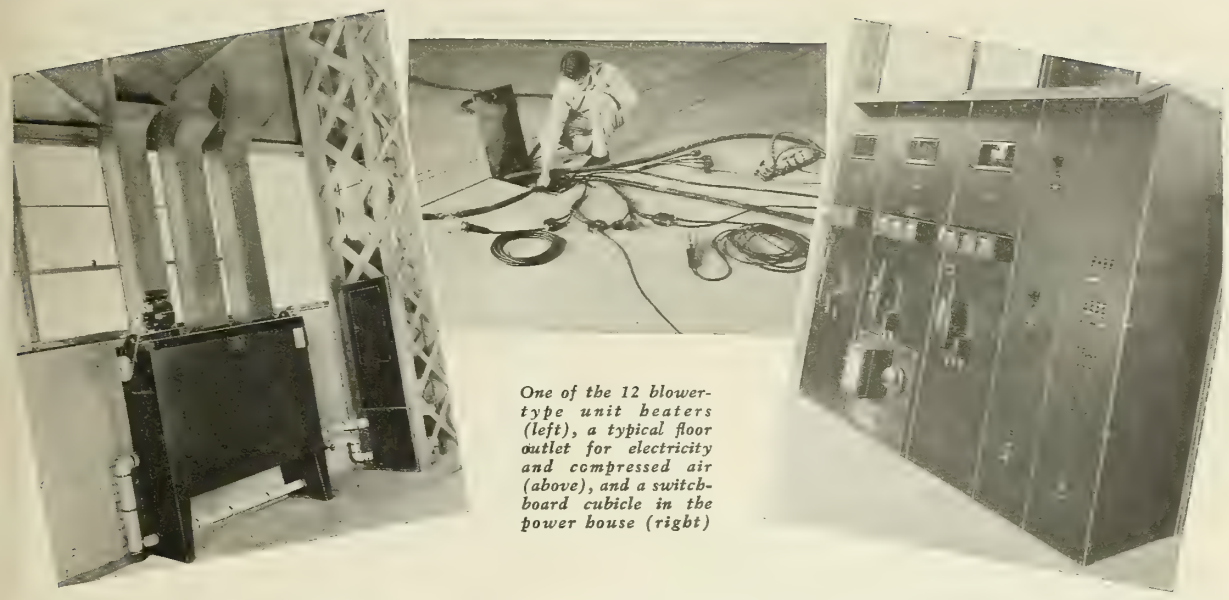
Completely encircling the new building is an 8-ft. steel fence provided with a 200-ft. gate opening directly in front of the apron. This opening is accomplished by two 100-ft. steel gates that roll across a concrete track and thence along suspended rollers until the maximum opening is reached. Thus, completed planes of large wing span may be rolled through the front doorway of the plant, across the apron, through the gateway, and directly onto King County Municipal Airport.

Most outstanding feature of the building is its unobstructed working area which comprises a floor that measures 200 × 300 ft., with overhead clearance of 35 ft. throughout the area and having no intermediate supports. To minimize the height of the building, in view of its proximity to the airport, and yet properly to support the roof structure above this large open area, the Austin Co. used huge flat type trusses instead of arched trusses. Seven of the main steel trusses weigh 44 tons each and have a length of 200 ft. Each is designed to sustain a live and dead weight of 250 tons. The intermediate roof structure includes 66 trusses, each 50 ft. long and spaced at 20 ft. intervals between the main trusses. In all 600 tons of structural steel and 22,100 sq. ft. of glass were used in the building. The front door measures 195 ft. wide by 35 ft. high, and is made up of ten 20-ft. steel doors operating on an outrigger track system which lays open the entire front side of the building. Despite the size and weight of these doors, one man can operate them.

Ample daylight is obtained by the use of the saw-tooth type roof and ventilation has been provided for by utilizing transoms, each 200 ft. long, installed in each of the 5 saw-tooth monitors of the roof. These transoms are electrically operated by motor-driven tension-type operators, with push button controls at the floor and with limit switching for automatic stopping at the closing point and full opening.

*Nine of these type YB-17 bombers may be assembled at one time in the new Boeing assembly building*





*One of the 12 blower-type unit heaters (left), a typical floor outlet for electricity and compressed air (above), and a switchboard cubicle in the power house (right)*

Control buttons enable them also to be stopped at any desired intermediate opening.

Installation of a monorail system is contemplated for handling engines, wings, fuselages, and other parts inside the assembly shop—the monorails being suspended from the bottom chord of the long roof trusses. A frame catwalk along the side walls just below the trusses gives access to the framing so that the monorails may be adjusted and lighting fixtures may be cleaned or replaced.

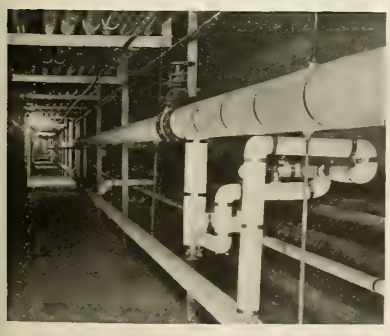
Rear and side wall base portions of the building are brick, 6.5 ft. high and 8 in. thick. The remainder of the siding consists of two thicknesses of galvanized steel plate, with an inch of insulating material between—calculated to afford temperature protection equivalent to a 12-in. brick wall. To facilitate possible future expansion, bolts have been used to attach steel girts to the columns around the three sides and to attach steel sash and insulated siding to these girts. There are four continuous bands of horizontal steel sash surrounding the building on all sides, including the steel front doors. Chain-operated transoms in the side wall sash supplement roof transom ventilation.

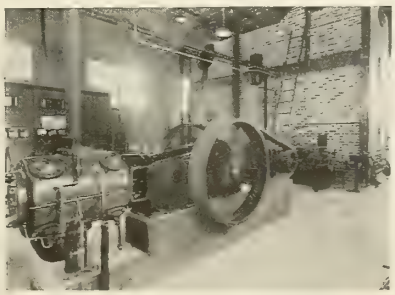
Another feature of the building is the accessibility of service facilities. Electricity, steam, compressed air, water and gas lines enter the building through an underground concrete tunnel leading from a nearby power house. Six tributary tunnels branch from this main tunnel beneath the floor with access openings every 20 ft. and outlets for electricity and compressed air connections every 40 ft. The main tunnel is 360 ft. long, 7 ft. wide and 6 ft. 9 in. high, located alongside the building just outside the building line so that its concrete roof would be flush with the adjoining floor if the building should be expanded in that direction. Inside the tunnel are a 5-in. steam main, a 3-in. air main, a 4-in. water main, a 1.5-in. gas main, a sewer line, telephone lines, and conduit for wiring. The smaller concrete tunnels, 15 in. wide and 24 in. high, carry compressed air, electricity, steam return lines from the heating system, and water piping.

General illumination inside the building is provided by eighty-four 750-watt lamps arranged in diamond patterns, with lights spaced every 30 ft. in rows across the building and with 25 ft. between rows, in line with the bottom chord of the roof trusses. This artificial lighting provides 12 ft. candle intensity at the bench level throughout the building, and lighting for concentrated work is provided by special fixtures on jigs and portable working lights fed from the floor outlets.

The 30 × 50 ft. power house is located just opposite one of the rear corners of the main building in such a position that it would be centrally located in case of expansion of the new plant. It is outstandingly modern in equipment, and all switches, oil circuit breakers, disconnect switches, bus bars, instrument transformers, watt hour meters and a graphic recording watt meter, are enclosed in a single dead front switchboard cubicle.

Incoming power (4300 volts) enters the power house by way of the concrete tunnel and is led directly to the center section of the cubicle, through main disconnect switches, main oil circuit breakers and bus bars, and thence to the lighting section of the cubicle at the right and the power section at the left. Behind the





*Underground tunnel between power house and assembly building (left), air compressor and 250 hp boiler (above) and wash basins serving 50 men simultaneously (right)*





*Interior of new Boeing assembly building, showing unobstructed area; note 4-engined bomber in background*

cubicle are 5 Pyranol transformers. The lighting section of the cubicle serves three 250 KVA transformers, reducing current to a 120-208 volt, 3-phase, 4-wire distribution system. The power cubicle serves two 100 KVA power transformers which step down the current to a 440 volt, 3-phase, 3-wire power distribution system.

Switching equipment is sufficiently large to serve all possible future expansion of the plant. When any of the doors to the cubicle are opened, automatic limit switches cause the oil circuit breakers to open, thus killing the current in all exposed conductors. Over-current and under-voltage protective devices trip out the oil circuit breakers in case of excessive current or deficient voltage. From the power section of the cubicle, the circuit leads at present to a power distribution panel stationed close to the air compressor in the power house and to an outlet plug in a corner of the main building where such equipment as portable arc welders may be attached to 440 volt, 3-phase power.

The air compressor (delivering 293 cu. ft./min.) is driven by a 60 hp, 440 volt, 3-phase induction motor. Low voltage current from the lighting transformers is carried by 3 feeders through the main tunnel to 3 distribution centers on columns on the wall of the assembly building. Each of the feeders is a 4-wire system with 3 hot and 1 neutral wire. Through these distribution centers, floor outlets are furnished with single phase, 120 volt current, each floor tunnel containing 10 circuits and each circuit provided with two 20-amp. receptacles for 3-wire polarized plugs—the third wire serving as a ground for drills and electric tools in operation. Plugs are of the twist-lock type to prevent accidental detachment.

The 3-phase, 208 volt circuits serve oil and gasoline pumps at the corners of the building. One 3 hp pump is used to pump fuel oil from tank cars to a 12,000 gal. storage tank buried beside the power house. In conjunction with the pumping apparatus, there is a steam hose connection which may be attached to the heating coils of tank cars so that the temperature of the oil can be raised sufficiently to give a free flow. Another 3 hp pump is used in connection with an 8000-gal. gasoline tank buried alongside the apron and connected to a gasoline hose pit at the end of the apron.

The heating system centers in a 250 hp Sterling boiler, with steam-atomized oil burner, located within the power house. A steam driven pump brings the fuel oil from the storage tank, heats the oil, and builds up its pressure for the burner. Compressed air equipment is also provided for starting the furnace—atomizing the oil with air in place of steam. A steam-operated boiler feed pump, automatically controlled, maintains a constant water level in the boiler. Steam is carried through the tunnel system to 12 blower type unit heaters within the assembly building, operating at 100 lbs. steam pressure, and each calculated to be equivalent to 2000 sq. ft. of cast-iron radiation. Equipped with a ¾ hp motor driving 3 fans, each unit heater delivers warm air at the rate of 4500 cu. ft./min. Three heaters are on each side of the building, 2 at the rear wall, 2 over the front doors, and the remaining 2 are mounted on roof trusses. All are properly directed to furnish a complete circulation of heat over the entire area. Despite the fact that the building contains 2,100,000 cu. ft. of unobstructed working space, it can be brought to working temperature by this heating system in an hour in moderate weather. Operating at full capacity, the heating system for the present building requires only 173 of the boiler's 250 hp.

A lean-to portion at one side of the building houses lavatory facilities, including 5 circular wash basins operated by foot controls and capable of simultaneously serving 10 men each. A separate building has been erected as a lunchroom for employees working in the assembly unit.

Fire protection is provided by a complete automatic sprinkler system including a 150,000-gal. emergency sprinkler tank which may be used in the event of failure of the City water supply. A water pump, driven by a 125 hp motor, automatically switches on and pumps water from the emergency tank into the sprinkler system when the pressure in the sprinkler main drops to a predetermined low point.

# *Congratulations*

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# DRAG OF FUSELAGES WITH VARIOUS CONTOURS

HERBERT DE CENZO AND EARNEST ROONEY

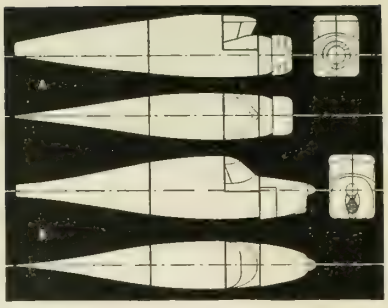


*Fig. 1. Model with interchangeable parts*

● Controversy concerning the advantages of certain fuselage, engine and windshield contours prompted a drag test investigation of various models in the 7 × 10 ft. wind tunnel at the University of Detroit.

Principally, these tests were made to find a more suitable shape for a cabin fuselage which offered minimum resistance to airflow. To accomplish this, 12 forms of engine, fuselage and windshield arrangements were tested, the contours being made by a combination of models of 2 aft sections of fuselage, a cabin, 3 windshields, and an in-line and radial air-cooled engine. Each assembled model was equal in cross-sectional area.

Construction of the 8-piece laminated white pine fuselage models is shown in figure 1. The main body, to which the tail pieces, windshields and engines were attached, was the model of the cabin section of a standard 4- or 5-place cabin airplane. The first tail piece (A) is of conventional lines having a slight convex form. The concave tail piece (B) is a model of close approximation to that of another of the present day airplanes.

The 3 windshields used in the tests are shown in figure 2. The "V" forward slanting type which is similar to that quite popular a few years ago on transport planes, has two flat front panes, but the side panes are slightly flexed on two corners. This windshield is referred to as model No. 1. The windshield designated No. 2 has two flat front panes and two flat side panes. No. 3 windshield, of conical type, is unusually clean, having no corners, but double curvature at some points. The pane, itself, however, has single curvature forming a section of the frustrum of a cone.

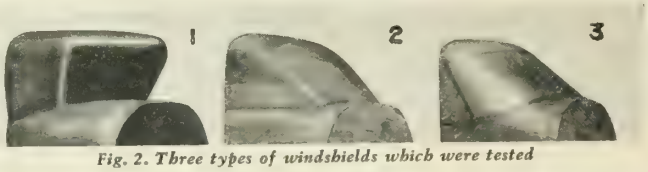



*Fig. 2. Three types of windshields which were tested*

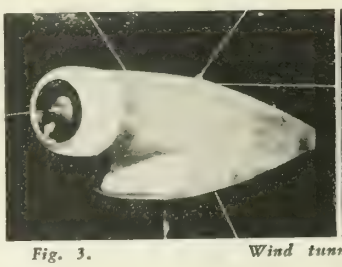


*Fig. 3.*

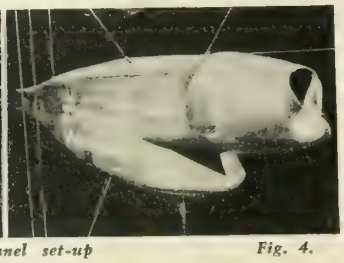


*Fig. 4.*

*Wind tunnel set-up*

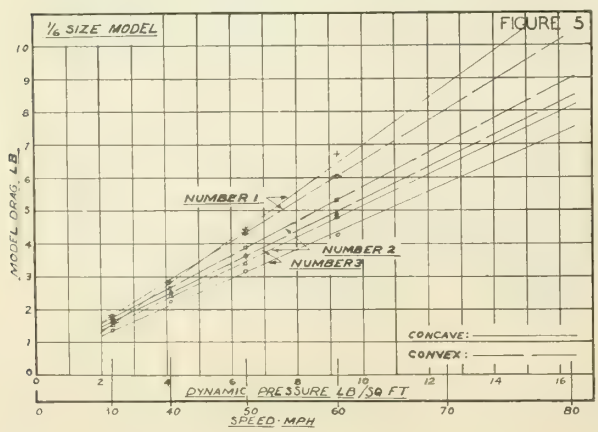
The radial engine is of the 9-cylinder type equipped with an NACA cowl; the in-line engine is a 60° V-12 inverted air-cooled type which was provided with a 16-mesh wire screen at the air inlet to represent the drag caused by cylinders.

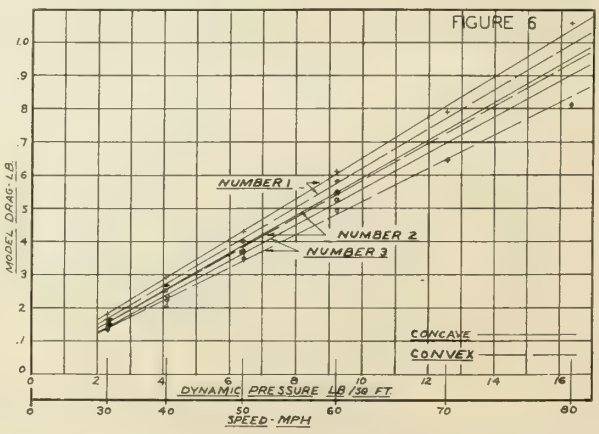
All of the models could be quickly assembled and disassembled by screws and tapered dowels so that the tests could be conducted rapidly and accurately. Figure 3 shows the model with the convex tail piece, the No. 1 windshield and the radial engine; figure 4, the concave tail piece, No. 1 windshield and the in-line engine.

### Wind Tunnel Apparatus and Results

Readings were taken on automatically-operated instruments. Drag balance was operated automatically by an electric motor which reduced errors to a minimum; wind tunnel speed was measured by a pitot static tube connected to an inclined

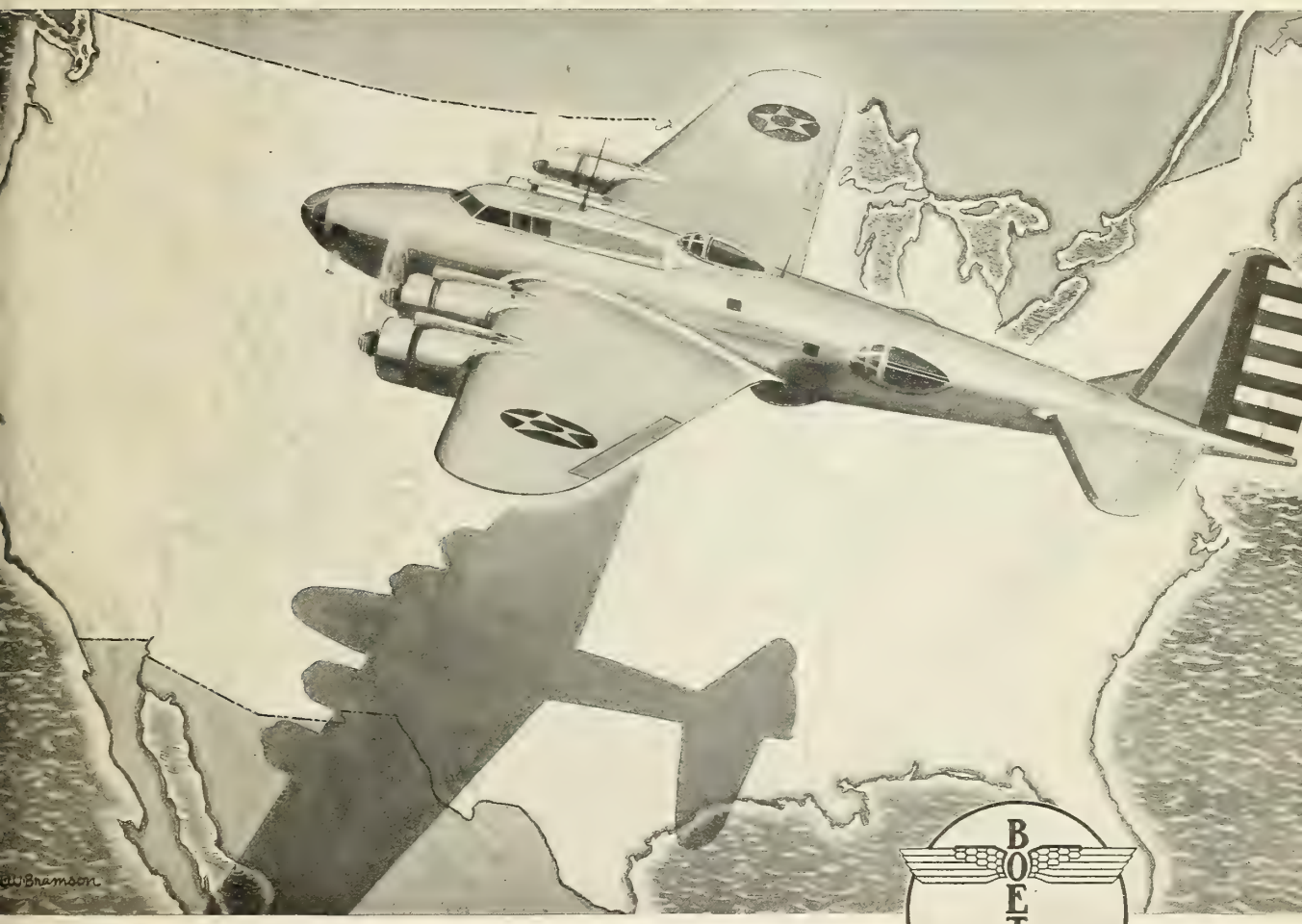
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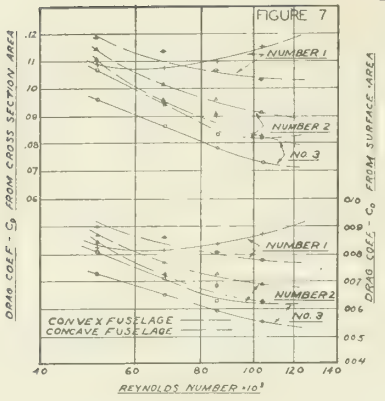


# DEFENSE . . . *in step with the progress of a Nation!*




Built by Boeing for the United States Army Air Corps, this giant four-engined bomber and her 12 sister ships are bringing to the world a new concept in aerial defense. Too, these stalwarts portend the brilliant future of commercial air transportation as have other Boeing Bombers of the past. ☆ Thus through its farsighted policy, the United States Army not only provides continued assurance of national security, but once again quietly performs one of its characteristic services to civil progress by introducing the trend of tomorrow's air transports.

*Boeing has always built tomorrow's airplanes today!*




*(Continued from preceding page)*

tube manometer, and every precaution was taken in mounting the models to obtain consistent results.

Results of drag tests at 0° angle of pitch of concave and convex fuselages with radial (figure 5) and in-line engines (figure 6) with three windshield contours, indicate that the No. 3 windshield is superior in all cases while No. 1 is unsatisfactory. It is interesting to note that the difference in drag between the various windshields is the same proportionately for both figures.

Although No. 1 windshield offers a high drag it has one advantage in that it does not reflect light from the ground into the pilots' eyes. It was hoped that a good design with a low drag could be attained and for this reason a large radius was put on the top corner of the windshield. Though No. 2 and No. 3 windshields will reflect ground lights, their low drag is such that they are popular.

Comparing the drag of the 2 rear portions of the fuselage, it may be seen from figure 6 that the convex fuselage with No. 3 windshield is the best arrangement for the in-line engine, while the concave fuselage and No. 3 windshield is slightly inferior. In figure 5, with the radial engine, it is evident that the concave fuselage and No. 3 windshield gives the best result, while the convex fuselage with No. 3 windshield is slightly inferior.

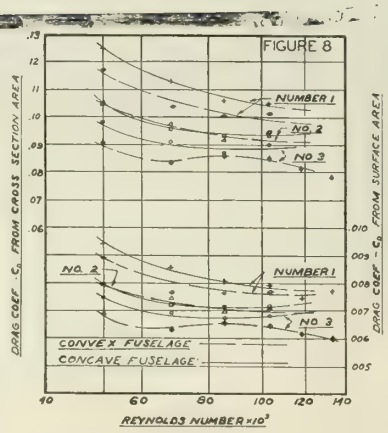
Results shown on figure 5 and figure 6 indicate that with the in-line engine the convex fuselage has an advantage in reduced drag. With the radial engine, the opposite is true, the concave fuselage being superior. Fuselage design is more critical with the radial than with the in-line engine and the proper type of windshield is an important factor for the in-line type.

### Drag Coefficients

The coefficient of drag for concave and convex fuselages with radial (figure 7) and in-line engines (figure 8) and three windshield contours, is plotted against a logarithmic scale of Reynold's Number. In both graphs, there are two similar curves for each fuselage arrangement due to the use of two drag coefficients. One $C_D$ is based on cross-sectional area while the other is based on surface area. The former was chosen because the $C_D$ in the past has been based on frontal area. The latter was computed due to the new theories and procedures which are being set forth at the present time. An explanation of these may be found in References 1, 2 and 3 at the end of this article.

The characteristics of these curves are identical to those already described. However, it is important to note the decrease of $C_D$ with an increase in Reynold's Number. In this connection it might be said that screw or rivet heads, lapped joints and other roughness in the air stream causes the $C_D$ to decrease more slowly with increase in Reynold's Number, while in extreme cases the $C_D$ will remain constant. Further discussion on this subject can be obtained from the April, 1936, issue of *Aircraft Engineering*.

In considering the drag coefficient based on surface area, reference should be made to figure 10; the two curves were obtained from the expressions that identify them (further analysis of these formulas are found in References 1 and 2). The $C_{Df_a}$ curve is the one for turbulent flow, while the laminar flow follows the expression for $C_{Df_b}$. There may be a combination of these two, but for the Reynold's Number of this test the curves were out of range. By comparing figure 7 and figure 8 to figure 10 the type of




flow about each fuselage may be easily ascertained. All of the $C_D$ curves are slightly above the $C_{Df_b}$ curve indicating that the flow about the fuselages is laminar with slight turbulence. In this connection it may be said that the wind tunnel turbulence factor is 1.1%.

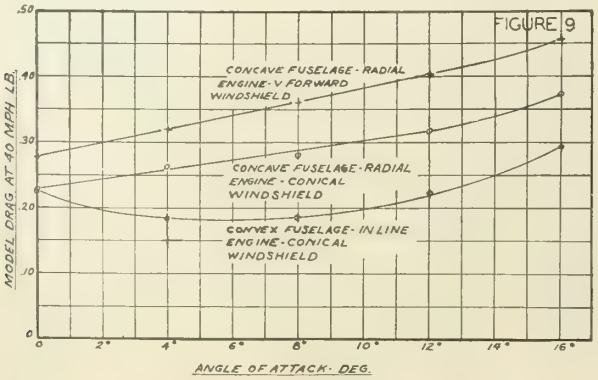
Variation of fuselage drag at various angles of attack is shown in figure 9. With the exception of the convex fuselage arrangement, drag increases at a constant rate until an angle of attack of 14° is reached. With the convex fuselage, in-line engine and No. 3 windshield arrangement, a different type of curve was obtained. By comparing it with the other curves, the only conclusion arrived at is that the shape of the curve is due to the combination of the in-line engine and No. 3 windshield.

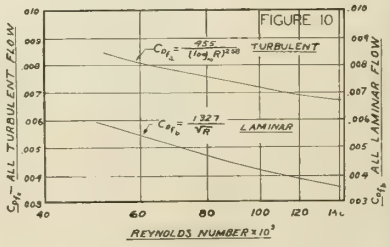
### General Conclusions

From the preceding discussion it has been ascertained that the various combination of arrangements of models of fuselages, engines and windshields may be tabulated in the order showing least resistance as follows:

| Fuselage aft section | Engine | Windshield |
|---|---|---|
| Concave | radial | Number 3 |
| Concave | radial | Number 2 |
| Convex | radial | Number 3 |
| Convex | in-line | Number 3 |
| Convex | radial | Number 2 |
| Concave | in-line | Number 3 |
| Convex | in-line | Number 2 |
| Concave | in-line | Number 2 |
| Convex | in-line | Number 1 |
| Convex | radial | Number 1 |
| Concave | in-line | Number 1 |
| Concave | radial | Number 1 |

*(Continued on page 89)*



# 15 SEAT-VIEWS

These 15 photographs were taken from the 15 seats of an S-43 . . . at passenger-eye-level. Note the clear unobstructed panorama which greets the eye of the traveller . . . no matter which seat he selects. Only from a high-wing transport like the S-43 can each passenger enjoy the full sweep of the sky, earth and water from aloft.

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# Airport Development by Progressive Stages

MAJOR F. E. HULSE*

● The idea of project development by progressive stages is by no means new. Many communities have carried on construction programs under a two-to-five-year plan in other enterprises, and similar methods may be employed in the construction of airports. Airport construction has become a highly specialized department of engineering in the last few years, and it is hoped that this brief outline of the important features to be considered in airport construction by progressive stages will be of value to municipalities planning airports in the near future.

From the start it will be to the advantage of the municipality to employ a competent airport engineer, one familiar with all branches of aviation as well as the engineering problems involved to make a careful survey of the locality for a proper site. No money, however, should be spent for property until the complete detailed plans of the airport have been drawn up and studied. By so doing, the possibility of abandoning a partially developed site (which has happened in a number of instances) will be avoided.

In the choice of a site these factors must be considered; easy access to the center of commercial activity, taking into consideration "time distance" (the measure of time required to reach the site by ordinary means of transportation, automobile or bus); property ownership; location preferably on the windward side of the city to eliminate smoke nuisance; topographical features with respect to soil and drainage, maximum natural drainage with minimum grade and earth movement, a soil as pervious and absorbent as possible with a good firm top soil; freedom from obstructions, such as high buildings and tension power lines; sufficient area to allow for at least one 5000 ft. runway in the direction of the prevailing wind, preferably an area approximately 5000 ft. sq. to give an all-way landing field.

Having located the most suitable and economical site, the engineer can prepare the master plan of the ultimate airport. Such plans should include grading, drainage, surfacing, hard surface runways and taxi-strips, lighting, radio landing beam and hangar facilities, with the specifications and estimated cost of each item.

With the detailed plans and cost estimates completed, the municipality can then proceed with the program of progressive development. The usual stages to be followed are: (1) acquisition of site; (2) passing of zoning ordinances; (3) grading; (4) drainage; (5) surfacing of runways and taxi-strips; (6) seeding of turfed areas; (7) lighting; (8) radio landing beam; and (9) buildings, etc.

The first stage of construction may be only leveling or grading the field. If this is all that can be attempted at the start, then grading should be undertaken with future runways and taxi-strips in mind. This can be accomplished by establishing at the outset the definite direction, length and width of the runways and taxi-strips, stripping the surface of top soil and building a sub-base of suitable material, usually graded gravel, which will later become an integral part of the permanent pavement sub-base. This should be placed at the calculated elevation in accordance with the gradients established on the master plan. The sub-base then may be covered with top soil and used for landings with a reasonable assurance that the strips so prepared will not be kept considerably dryer than the surrounding field surfaces during periods of heavy rains and spring thaws. The gravel sub-base acts in this case as an absorbent and conductor to the sub-strata.

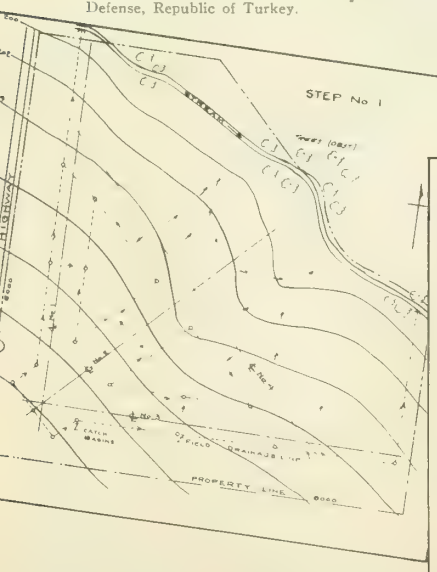
General field grading may necessitate movement of a considerable quantity of material to obtain the gradients calculated. However, study of the topographical plan of the site will enable the engineer to establish his gradients to equalize the amount of cut and fill necessary at the lowest cost. Whenever possible a definite plan of earth movement should be devised, based upon a previous soil survey, so that fill, base material and top soil may be utilized to the best advantage and avoid the necessity for obtaining materials from outside sources.

Coincident with the grading, the problem of drainage should be considered. Where only turfed surfaces are to be used, all-weather service cannot be maintained throughout the year without an adequate drainage system.

Drainage should be based upon the results of soil tests, a topographical survey, and a study of the rainfall data for the locality. A system which is adequate for one locality and site would be totally unsuited for another due to vast differences in soil and climatic conditions. Therefore the extent and type of the system depends entirely upon the locality, climate and nature of soil encountered. Where there is a possibility of freezing conditions, it is necessary to design a system adequate to remove the total surface flow at a fairly rapid rate, and this may be accomplished only by the use of proper surface grades to conduct the water to an open

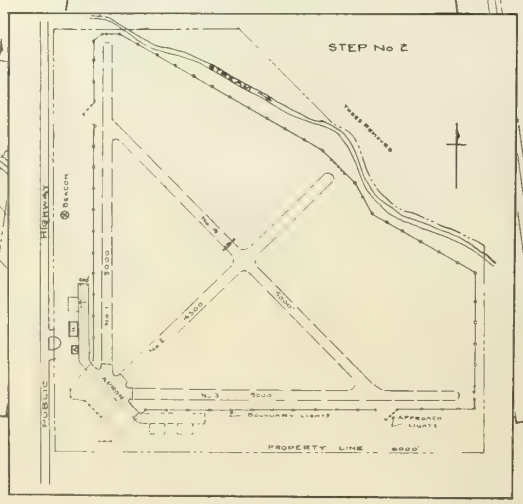
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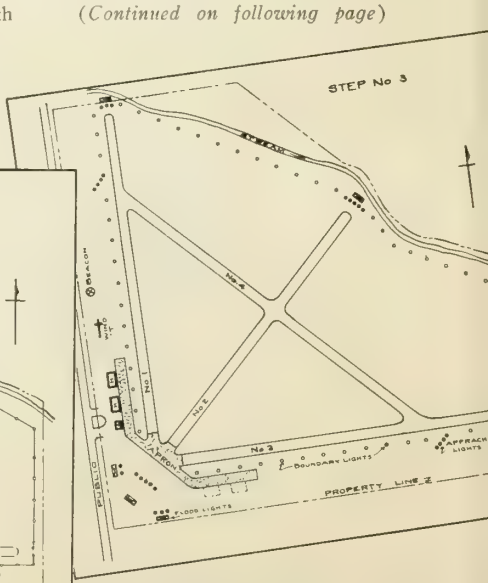
* Airport Engineer for A. P. Taliaferro, Jr., & Co., Inc. Resident Engineer for R. I. State Airport; Formerly, Airport Engineer and Foreign Relations Representative for West Indies Division, Pan American Airways, Inc.; and airport and Airways Engineer Consultant for the Ministry of National Defense, Republic of Turkey.




*Make topographical survey of property; grade and drain in relation to center lines of future runways; locate buildings*

*Construct administration building, service hangar, concrete apron; for runway expansion, prepare raised gravel base, cover with sod; seed inter-areas; install light circuits, rotating beacon*




*Complete airport; construct remainder of apron, hard surface runways; install wind tee, floodlights, radio*

# PROF. HARRIMAN HAD INGENUITY

## ... but 1883 had no gasoline




*Illustration above from a circus poster drawn in 1883 by Emil Roe and now in the Bella C. Landauer Collection. Certainly in those days it must have been daring . . . as well as fanciful. Imagine the sensation aroused by the modern bathing-beauty uniform of the attractive co-pilot!*

FIFTY-FOUR YEARS AGO . . . ladies in bustles and bewhiskered gentlemen were "ah-ing" and "oh-ing" at this circus poster . . . and paying their dimes to get into "Bartlett's Monster Railroad Show" and scoff. And well they might. For the dreams of flying machines in '83 lacked not only structural essentials, but would-be inventors also lacked gasoline motors, electrical devices, and a hundred other integral parts of "The Coming Mode of Travel." Changing this clanking dinosaur of Professor Harriman's imagination into the airplane of today has been accomplished—not alone by inventors, engineers, and the pioneers of aviation, but also by the research laboratories of electricity, metallurgy, chemistry, and petroleum.

Even the gasoline that succeeded at Kitty Hawk in 1903 would scarcely satisfy the airliners of today. In fact, 1937 performance with Ethyl Aviation Gasoline offers an interesting contrast to the performance of only a few years ago. Ethyl Gasoline Corporation, Chrysler Building, New York City.

(*Continued from preceding page*)
or closed joint sub-soil drainage system below the frost line. For relatively impervious soil such a storm sewer system would be proper. On the other hand, where the soil is pervious and permits rapid absorption, simple open joint drains may be used to advantage.

The factors determining the type and size of sub-drains apply equally to field and under-runway drains. In the case of under-runway drains, which are taxed with the large concentrated volume of runway surface water, it is recommended that they be constructed as storm sewers rather than open joint French drains. By using French drains or field drains (those laid in a trench and covered with graded crushed stone and gravel, the pipes having open joints) there is a possibility of the formation of a void directly under the concrete slab of runway. This is due to the fact that the cover material of the drain fills the openings in the crushed stone with constant filling and discharge. If, however, it is a question of lowering the normal water-table under such a runway the French type with slight modification may be used to advantage—6 to 8 inches of crushed stone being used as a cover material over the open joints and the rest of the backfill being of firm impervious material. It is recommended that all drains be designed to accommodate a minimum runoff of 2 inches an hour.

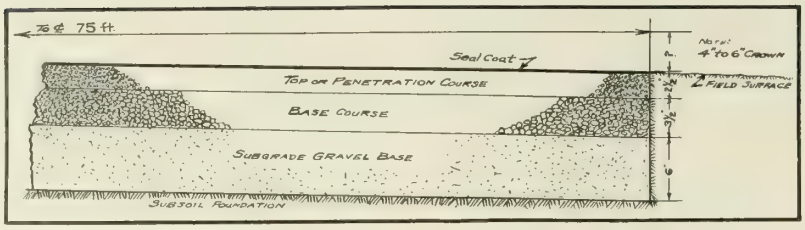
Provided with an adequate drainage system, a graded surface, a prepared subbase for runways and taxi-strips the next logical step would be the construction of permanent hard surface runways.

There are practically as many types of runway surfaces to choose from as there are highway surfaces, runway construction being similar to highway construction. The most suitable surface for any locality is that type which comes within cost limits set by the municipality and which is most readily adaptable to the natural soil conditions and materials locally available.

Under a given set of conditions, the surface that most nearly meets the requirements of durability, good drainage, frost resistance, good traction and longevity should be the one to be considered.

Before brakes and tail wheels were installed on airplanes it was believed that a more or less resilient surface was not only preferable but necessary, that relatively hard surfaces such as concrete should only be used for take-offs. But with the development of large heavy transport planes controlled by brakes, hard surface runways for all purposes are in demand.

There still exists a diversity of opinion as to which material constitutes the ideal for airplane traffic. Portland Cement concrete for landing surfaces has these advantages: longevity and durability, low frictional resistance, adaptability to the establishment of true gradients for drainage; good visability, suitability to easy snow removal and low maintenance cost. Though there is a high initial cost, it may be the most economical in the end.




***Section for hot penetration bituminous macadam runway***

Lower in cost than the Portland Cement concrete pavement are the asphalt or bituminous macadam types; then there are the various low cost road surfaces produced by grading or mechanical manipulation of the natural materials, such as sand, clay, shell, lime rock, slag, gravel, crushed stone and traffic-bound macadam.

Use of dispersed asphalt, which has the properties of an emulsion, provides another excellent method of construction. This type of asphalt is prepared by using a fluxing agent and it can be readily diluted with water. This treatment has been tried experimentally with excellent results, producing an even and close texture to the final surface.

In constructing taxi-strips any approved type of surface can be used, preferably one of the asphalt macadam types.

The next step in the development program is seeding the turfed areas between runways and taxi-strips. This operation should be done immediately after the field has been graded without waiting until the hard surface runways are built. A good firm turf is necessary for an all-way field. Seeding depends directly upon the organic and chemical nature of the soil, and, having a soil analysis, any recognized agricultural institution can advise the proper mixture of seed to produce the kind of turfed surface desired.

A full night lighting program should be planned and the various units should be installed as development progresses. To obtain a transport rating from the Department of Commerce the airport lighting should consist of: field boundary markers to define the extreme limits of the landing area; obstruction lights on all buildings, poles, towers or other obstructions; green approach lights for landing strips or runways; (hard surface runways may or may not be outlined by flush type runway markers); an approved type of airways beacon—the rotating type, with or without code flashing device; and an illuminated wind indicator—either a lighted wind tee or a smoke pot indicator with flood lights. In addition, there must be a field flood lighting system, the lighting consisting of one or more banks of lights which will produce a minimum intensity of 0.15 FC (foot candles) at the extreme limits of the field enclosed by the boundary markers. In the case of runways, flood light groups may be placed at either end with the maximum intensity along the center of the runways.

Without a detailed study of the actual airport and the conditions to be met it is difficult to arbitrarily state any fixed plan of illumination.

For continuous operation, adequate radio control is necessary, such a control system consisting of two-way radio communication, voice and key; radio course beacon and a radio beam for blind landings.

The problem of buildings is important, and a careful layout must be made at the start for immediate needs and future expansion. In designing the administration building, thought should be given to space allotment for operations, mail and express, radio control, passenger facilities, rest rooms, restaurant concessions, with possible hotel accommodations for overnight passengers and flying personnel.

Hangars may be constructed in accordance with the demand, but at least one large service hangar must be available. Such a hangar must be large enough to house the largest transport plane now in use or that may be expected to be used within ten years; it should have a clear opening of at least 150 ft. and a free head room of 36 ft. This hangar should be a part of the original plan of development owned and operated by the municipality. Privately owned hangars may be constructed at a later date and become a source of revenue to the municipality.

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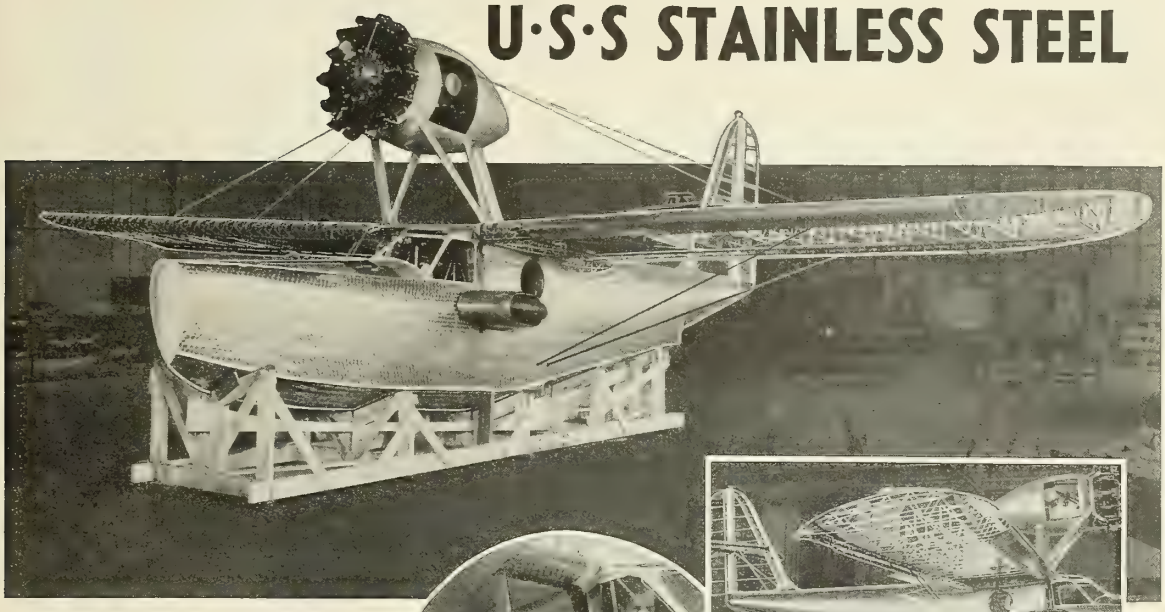
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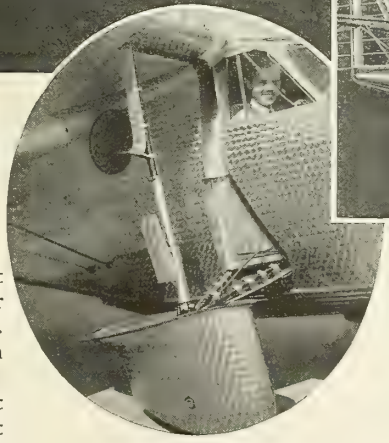
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**American City;** Dec. 1933. p. 11.

# BUILD LIGHTER AND BUILD STRONGER WITH U·S·S STAINLESS STEEL



*Here is an interesting construction view of the Fleetwings' Sea Bird which, except for motors and wing covers, was constructed entirely of "Shotwelded" USS Stainless Steel. As a result, this amphibian is not only stronger but over 200 lb. lighter than equivalent land planes of other metals!*





*Notice in these two views the exceptionally smooth, neat rivetless construction which is possible with "Shotwelded" USS Stainless Steel. In addition to perfecting streamlining and reducing air drag, this improved construction is also stronger and more rigid than riveting. Notice also the interesting detail of the retracting landing wheels.*

## *Yes, it is a fact!*

With brilliant stainless steel, aircraft can be built lighter and built stronger than with any other metal or alloy. Yes, lighter *and* stronger . . . both at the same time!

The explanation? Simply that stainless steel offers the greatest strength-weight ratio of all commercial metals—and that it is the only metal or alloy which is completely immune to atmospheric corrosion.

Because of this fortunate combination—extraordinary tensile strength plus immunity to atmospheric corrosion—the aircraft designer is free to build up thin members of USS Stainless Steel into light-weight sections and trusses of tremendous strength. And by using the "Shotweld" process of stainless steel fabrication, he can eliminate objectionable rivets, strengthen his plane, perfect his streamlining. The plane constructed of USS Stainless Steel becomes virtually one strong homogeneous metal unit; fuselage, wing structure, motor supports and landing gear all welded together.

To aircraft designers and fabricators, USS Stainless Steel offers a challenging opportunity to build new planes which are lighter *and* stronger, faster *and* safer.

*For further information on the Sea Bird, write Fleetwings, Inc., Bristol, Pa.; on the "Shotweld" process, write Edw. G. Budd Mfg. Co., Philadelphia, Pa.; on the properties and opportunities offered by USS Stainless Steel, address the stainless steel specialist in our nearest district office.*

# U·S·S STAINLESS STEEL

AMERICAN STEEL & WIRE COMPANY, *Chicago and New York*
CARNEGIE-ILLINOIS STEEL COMPANY, *Pittsburgh and Chicago*
NATIONAL TUBE COMPANY, *Pittsburgh*

Columbia Steel Company, San Francisco, Pacific Coast Distributors  United States Steel Products Company, New York, Export Distributors

UNITED STATES STEEL

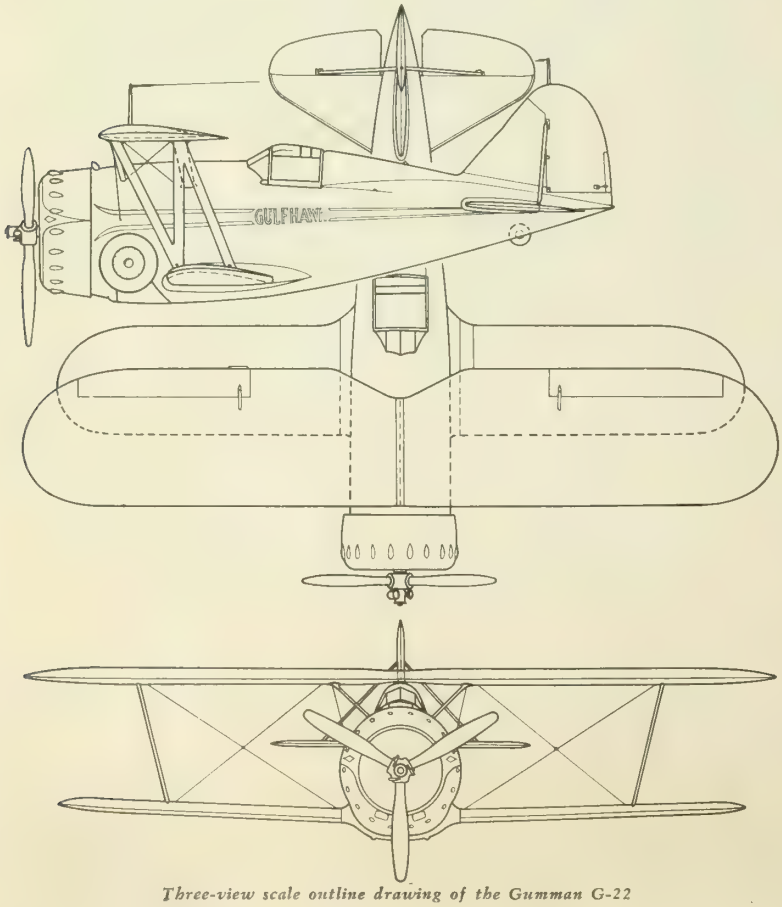
# Al Williams' Grumman G-22 Aerobatic Plane

**Powered with a 1000 h.p. Wright Cyclone Engine**




● A specially-built high performance Grumman biplane has been delivered to Major Al Williams, aviation manager of the Gulf Refining Co. Similar in appearance to the types produced by the Farmingdale manufacturers, the new Grumman, designated Model G-22, is particularly intended for the aerobatic and inverted flying which Major Williams has shown such a proficiency for many years.

Wings have aluminum alloy spars and ribs and covering is of fabric finished with Perry-Austin dope and lacquer. The upper wing, provided with inset ailerons actuated by control horns near their inner ends, consists of two panels joined at the center, "gulled" and cut-away to assist visibility. Bracing is provided by *N*-type streamlined dural tubing interplane struts, highly-polished. Lift bracing consists of two Stewart-Hartshorn streamlined flying wires in the same plane with double landing wires. The upper wing attaches to the fuselage by streamlined cabane struts and streamline wires. The lower port wing is equipped with a demonstration bomb rack and an Adams & Westlake flush type retractable landing light located just beyond the wing strut.




*Three-view scale outline drawing of the Gumman G-22*

All-metal construction is also used for the tail surfaces, the aluminum alloy tubing of the adjustable stabilizer and fin being covered with sheet dural and braced with streamline tubes of stainless steel. Fabric covering is used on elevators and rudder which is provided with a trimming tab adjustable from the cockpit. Leading edges of stabilizer surfaces have Goodrich rubber abrasion strips.

Streamlining has been enhanced by filleting at the wing roots and by fairing the fin into the lines of the fuselage up to the head rest. Removal of a circular head-rest pad gives access to a cylindrical storage compartment. Controls are equipped with Fafnir and Norma-Hoffmann ball bearings.

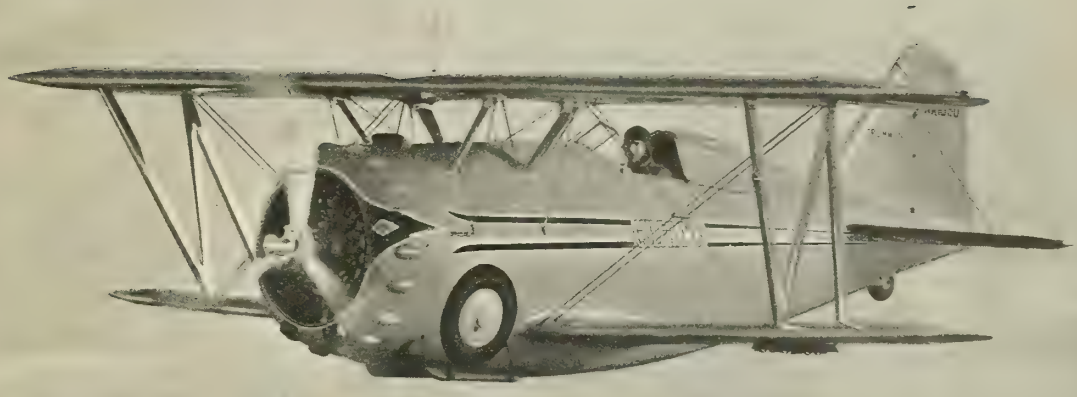
Landing gear is fully retractable and equipped with Bendix wheels and hydraulically-operated brakes, Goodrich tires, and latest Bendix *Pneudraulic* shock struts. Retraction of the gear into pockets at the sides of the fuselage is accomplished by manual control from the cockpit. The tail wheel is also retractable; a locking control in the cockpit provides means for securing it against swiveling.

Construction of the aluminum alloy fuselage follows monocoque design. The single seat cockpit is provided with a sliding transparent canopy top. The pilot's seat is quickly adjustable up and down by the pilot and designed for use of a seat-type parachute. A most complete array of modern instruments and accessories are installed. The main instrument panel contains Pioneer airspeed, rate of climb and turn and bank indicators; a Kollsman sensitive altimeter; a Sperry gyro-horizon and directional gyro, as well as a push-pull adjustment control for the 9-ft. diameter Hamilton Standard 3-bladed controllable-pitch propeller.

On the port side of the cockpit are an

*(Continued on following page)*

# AL WILLIAMS CHOOSES A GRUMMAN






GRUMMAN AIRCRAFT ENGINEERING CORPORATION

FARMINGDALE LONG ISLAND NEW YORK

(*Continued from preceding page*)

Ashcroft engine gauge unit, Scintilla ignition switch, Pioneer thermometer and oil pressure gauge, release handle for the Lux fire extinguisher system, and the breech of the Coffman cartridge-type engine starter manufactured by Federal Laboratories, Inc.

Other instruments and controls on the port side are the engine throttle, bomb release, rudder tab and stabilizer adjustments, tail wheel locking handle, landing light retraction control, Lewis thermocouple and Cambridge Aero Mixture Indicator.

Installations on the starboard side include an Elgin 8-day clock with a sweep second hand, a Pioneer manifold pressure gauge, Kollsman tachometer and a Pesco priming pump. In addition, there is a compartment for goggles, etc., next to the side of the fuselage, and a map case under the central panel. Mounted on a horizontal panel alongside of the seat, are a group of toggle switches for various electrical installations. On this side also are a Pioneer fuel quantity gauge, the radio switches and remote control crank-operated tuning dial, three-way fuel valve, Eclipse dynamotor, and the landing gear crank.

Below the center panel are a Pioneer accelerometer, magnetic compass, carburetor thermometer, and a manifold pressure gauge. The accelerometer is installed to further research on aerobatic accelerations and new forms of high speed maneuvers which are still unexplored and have not yet been exploited. The 12-volt storage battery compartment is located forward of the pilot at the side of fuselage, vented and having an external drain to allow inverted flying. It is accessible from the outside through a door hinged at the bottom and braced with side brackets to act as a shelf on which the battery may rest while being inspected. It is locked in position by Dzus fasteners.

The plane is distinctively finished in "Gulf Orange" produced especially by Perry-Austin, and striped with white and blue.

Radio equipment is installed to the rear of the pilot, forward of the baggage compartment and includes a radio transmitter and receiver produced by the Aircraft Radio Corp. Range is from 200-370 kc. and 4200-7000 kc.

Power is supplied by a 1000 hp Wright Cyclone Model R-1820-G1 engine with Breeze radio shielding and BG spark plugs. An NACA cowl is used; it is divided in halves to permit easy removal.

The oil and fuel system are designed for extended inverted flying; for this purpose, double feed lines and double venting are provided. Fuel is drawn from the center of the tanks so that a supply is assured regardless of the flying attitude of the plane. Fuel is contained in 3 tanks of 35 Al. alloy; main tank between wheel wells has a capacity of 74 gallons and behind it are two tanks of 44 and 22 gallons respectively, one above the other. A 12-gallon oil tank is located aft of the engine fire wall. Fuel tanks are accessible for removal by unfastening a screwed section of the fuselage covering adjacent to the wheel well on the starboard side. The extensive use of Dzus fasteners for inspection doors, cowling, etc., makes it possible easily to attach and detach a number of such parts without the aid of tools.

An emergency flotation system is provided to permit forced landings on water. Compartments in the wing and two in the fuselage below the floor of cockpit and baggage space (225 lbs. allowance) displace a load of 5764 lbs. This is about 40% in excess of the normal full aerobatic load of the airplane. Two vents from the fuselage buoyancy compartments have their outlets in the head-rest streamline, near the fin.

For aerobatic work the fuel load is reduced to 42 gals. which brings the gross weight of the plane to 3583 pounds.

Specifications and performances of the Wright Cyclone-powered Grumman G-22 are as follows:

| | |
|---|---|
| Wing span, upper | 28 feet 6 inches |
| Wing span, lower | 26 feet |
| Overall length | 23 feet 2 inches |
| Wing area | 230 square feet |
| Gross weight | 4195 pounds |
| Fuel | 140 gallons |
| Maximum speed (at 12,000 ft.) | 290 mph |
| Stalling speed | 62 miles per hour |
| Service ceiling | 26,000 feet |
| Rate of climb | 3500 feet per minute |
| Range at 250 mph | 900 miles |
| Range at 225 mph | 1000 miles |
| Range at 200 mph | 1180 miles |
| Range at 175 mph | 1500 miles |




*Major Alford Williams in his Wright-Cyclone powered Grumman G-22*

## SOVIET AVIATION

(*Continued from page* 31)

We have shown that the socialist economy provides favorable conditions for aviation not only in passenger and mail transport but also in different branches of industry and agriculture. In some applications—the destruction of insect pests, patrol and photography of forest land, sowing operations involving certain grains, aerial map-making, reconnoitering in fishery districts, etc.—no other country compares with the U.S.S.R.

To conceive the extent of this work a few 1936 figures (unofficial) follow: aviation's fight on insect pests embraced 1,622,600 acres; on malaria-breeding spots 7,721,875 acres. Other special applications covered 30,000 flying hours and the total special applications involved 160,000 flying hours. These figures not only demonstrate the present level of special uses of aircraft but also point to even wider uses in the future.

The hygienic and ambulance branch of aviation must be mentioned. In emergencies and accidents the Red Cross air ambulance service insures rapid delivery of physicians, specialists or the transport of patients to medical centers. It has already justified itself many times over by penetrating inaccessible communities to save scores of lives. The sanitary-medical phase of aviation, distributed at strategic points and efficiently managed, has made a place for itself, and people in all parts of the Union turn to it in time of need.

Satisfactory results have been obtained from the agitation-and-propaganda branch. On the initiative of the newspaper *Pravda* and other groups, the Maxim Gorky Squadron has been conducting stimulating industrial campaigns.

The trend of Soviet aviation during 1936 has been toward greater comfort for passengers, and the Stakhanoff movement of super-rationalization has spread into aeronautical affairs with gratifying results.

(*To be continued*)



# Away – TO A FLYING START..

NEVER satisfied to "let well enough alone" and dedicated to the traditional Stinson Policy of constant improvement without basic, obsoleting changes, the 1937 Stinson "Reliants" began coming off the Production Lines during the first week of January.

Champion of 1936, the "Reliant" is destined to lead again in 1937 because it embodies qualities that Owners and Users asked us to supply.

Admitting that the "Reliant" had the best combination of desirable flying essentials ever built into an airplane of its type, loyal Stinson Owners, who comprise the largest group of cabin plane Flyers in the Nation, urged us to go forward . . . to get more speed . . . even slower landing ability . . . better ventilation . . . a quieter cabin . . . better vision . . . additional comfort . . . improved accessibility.

Our Engineers have accomplished ALL of these improvements and added a few more for good measure. Months of designing, building, testing—then rebuilding and retesting until our Test Pilots said "OK For Production." Then weeks of retooling our Factory to produce this airplane in the largest quantity we have ever attempted and to the rigid Standards of Quality demanded by an Inspection Division which is a law unto itself because it has no Boss.

Many of our Distributors already have this 1937 "Reliant" for you to inspect and fly—more will be supplied to them as rapidly as Quality Production permits.

If you did not receive your copy of the 1937 Stinson Plane News, please ask for it. It is free and tells all about this 1937 Stinson "Reliant."

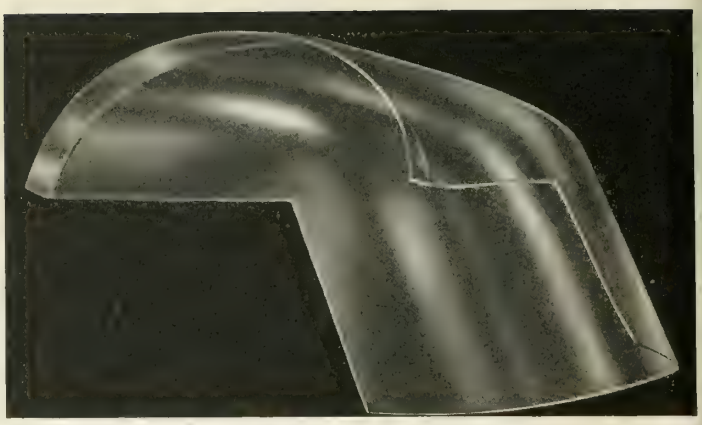
## STINSON AIRCRAFT CORPORATION

DIVISION AVIATION MANUFACTURING CORPORATION

**Wayne** **Michigan** **U. S. A.**

# PLEXIGLAS
## IN AIRCRAFT

**G. P. YOUNG**
Sales Department, Rohm & Haas Co.



*Plexiglas hood for a glider, formed of one piece and bent on three sides*

● Research in the field of plastics and synthetic resins has resulted in the development of a new type of flexible transparent sheet material which meets more fully the requirements of aircraft designers than any of the transparent materials previously available. This new product, known technically as one of the acrylic resins, is manufactured and marketed commercially under the trade name Plexiglas, by Röhm & Haas Co., Inc.

It is a tough, durable and light-weight synthetic resin of crystal-clear transparency, equivalent in light transmission to optical glass. At 1.18, its specific gravity is less than .5 that of glass. It can replace the much thicker and heavier laminated glass, and yet retain rigidity and resistance to breakage inasmuch as it has an impact resistance of 2-3 ft. lbs./sq. in. (Charpy notched bar). It is also lighter in weight and more transparent than cellulose acetate and cellulose nitrate (its light transmission is between 94% and 95%).

The resistance of Plexiglas toward discoloration and crazing upon weathering and aging is another of its features.

*Inside of the airship Hindenburg showing Plexiglas installation*



Showing 18-19 on the Brinnell scale, it is considerably harder than other resinous transparent sheet materials, and consequently offers greater resistance to abrasion. Dull surfaces may be readily polished to transparency by using mild abrasives and a soft buffing wheel.

A felt disc making 250 rpm wet with a mixture of fine rouge and water is used for preliminary polishing. The final polishing is done by a silk buffing wheel of 8-10 in. diameter making 2000 rpm. This disc is wet by tripoli or by a polish made from turpentine and chalk. Care must be taken to keep the polishing wheel moist and not to apply too much pressure to the piece being polished, since if the Plexiglas becomes warm, the wheel will ridge the surface. Slight surface scratches are easily removed by rubbing the sheet by hand with a soft cloth moistened with a turpentine-chalk mixture.

Since Plexiglas is a thermoplastic material, it may be formed into various shapes by heat and pressure. The softening point, about 175° F., is high enough that the material does not lose its rigidity under sun temperatures, yet low enough that it may be worked readily without using excessively high temperatures.

The ability of this material to be formed into curves makes it applicable for use in curved sections corresponding to streamlined forms. Since sheets as large as 36″ × 48″ are available, large curved sections may be made in one piece, thus eliminating frames which would obstruct vision. It must be remembered, however, that any curvature in a transparent material produces some optical distortion dependent upon the axis of curvature with relation to the point of observation. This is as true of Plexiglas as of optical glass or laminated plate glass.

Plane sheets may be bent readily by warming the Plexiglas to 90°-125° C., depending on the thickness of the sheet, and bending around a wood or metal form covered with rubber or glove cloth. Although either hot water or hot air may be used as heating mediums, the latter is preferred. The plane sheet is heated to the desired temperature, the sheet pressed over the cool form, and allowed to cool in the bent position. For sections of cylindrical surfaces, the plane sheet may be drawn around the form by pulling along the edges. However, for sections of conical surfaces it is advisable to use both male and female parts of a form, placing the sheets between these two parts. Sections of spherical surfaces may be drawn from plane sheets by pulling the sheets around a form shaped as part of a sphere. Surfaces of the forms must be smooth and must be covered with a soft material. Care must be taken not to press on the warm surface with the fingers, as the softened surface readily takes impressions.

While Plexiglas is not affected by mineral oil, gasoline or water, it is soluble in organic esters, such as those used in solvents for airplane dopes and lacquers, and must therefore be protected from such liquids. It lends itself readily to machining operations, and may be cut readily by a band, circular or jig saw. Although Plexiglas cannot be cut on a straight shear at room temperature, it may be readily cut with a shearing machine or blanking die at 180° F. It may be drilled satisfactorily if care is taken not to apply too great pressure on the drill to avoid chipping, and in machining operations, work should not be confined too long in one place to avoid softening the material by the generation of heat.

Recommended procedure for installation of Plexiglas is similar to that for laminated glass, consisting of fastening the edges of the sheets in a packed channel using a sealing material to prevent the entrance of water. Although Plexiglas may be drilled and then riveted into place, it is advisable to use oversized rivet holes to allow for contraction and expansion of the plastic material.

Wyman-Gordon have been developing and manufacturing aircraft forgings since the beginning of the aircraft industry. Every Wyman-Gordon product is the result of the most exhaustive research and laboratory tests.

One standard for Wyman-Gordon quality—nothing but the best should go in the air.




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"GUARANTEED FORGINGS"

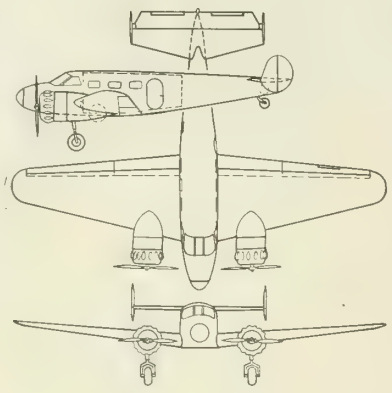
# Eight-Place Twin-Engined Beechcraft Model 18 with Jacobs or Wright Engines

● Although Beech Aircraft Corp.'s new twin engined airplane differs radically in design and construction from the planes it heretofore produced, the Model 18 nevertheless supplies more extensively the needs of the private owner and charter operator markets than the unusual reverse-stagger biplanes familiarly associated with the Wichita organization's output.

Designed by Walter Beech and his chief engineer T. A. Wells, the new plane has been developed to meet requirements of low initial and operating costs coupled with the long range, cabin comfort and safety comparable to that found on the airliners it closely resembles; the ability to operate from small fields, and a structure that can be repaired in shops outside of the factory.

Construction is all-metal, incorporating several modifications not usually found in airplanes of the same size and type. In general, the Model 18 is a bi-motored low-wing cabin monoplane with semi-monocoque construction and a fully retractable landing gear and tail wheel. Standard seating arrangement provides for 6 passengers in the cabin and 2 pilots forward. However, this may be varied to suit the requirements of the customer who might want 4 seats in the cabin or 2 seats and a lounge—the arrangement of the first plane now undergoing flight tests.

Fuselage structure, following largely conventional pattern, consists of built-up bulkheads fitted with extruded section stringers with smooth skin riveted to both. The center section differs from conventional construction details in that it includes a single heat-treated steel tube spar which is fitted into the fuselage to provide a convenient structure to carry engine, landing gear and wing stresses. With this construction it has been possible to bend the spar back from the attachment points on the fuselage and to place it just ahead of the front cabin bulkhead at the proper position in the center-section to carry the loads. This arrangement leaves the cabin entirely unobstructed so that all of the space can be used as desired. The balance of the center-section consists of dural ribs, a light rear spar for the flap hinge, stringers and skin.



*Outlines of the Beechcraft 18*

### Construction Details

Outer wing panels are of simplified design. Excessive bending stresses are carried by a heat-treated welded tube monospar which bolts to the center-section beam and extends through all critical sections of the wing. Approximately half way to the tip it is spliced to a dural girder. This arrangement avoids complicated structure in the root section of the wing. The skin carries only drag and torsional stresses, except at the outer end where the skin, in conjunction with the dural spar, absorbs the combined forces imposed. Continuous dural ribs, tied together by a light spar carrying the aileron and flap hinges are fitted to the spar. Extruded dural stringers extending spanwise of the wing complete the structure with smooth skin riveted to all parts.

Wing section is the NACA 230 series tapering 3:1, with a 3.5° wash-out at the tip to overcome stalling tendencies. Ailerons are of conventional dural sheet, with fabric covering, and a trim tab is mounted on the left control. Flaps are of the aileron-type, of fabric-covered construction similar to that of the aileron and extending inwardly to the fuselage. Flap operation is by electrical means, an independent motor permitting its use at the takeoff.

A conventional semi-monocoque stabilizer which fairs into the fuselage contour, and dual fins are used in the tail section. Rudders and elevator are of welded tubing, fabric covered, with a trim tab on one rudder and others on each half of the elevator.

Landing gear is electrically retractable and consists basically of a single forked leg to which is attached an arm. One end of the arm slides on a tube inside the nacelle and when the gear is retracted the leg swings backward into the nacelle. When the gear is down, the arm acts as a drag brace for the leg. Retraction projects the wheels slightly, permitting belly landings without damage to the cowling on the nacelles. The air-oil shock absorber has a vertical travel of 8 in., and combined with Goodyear 29 × 13 × 5 low-pressure tires this allows a landing descent of 600 ft./min. without exceeding 66% of the design load. Brakes are actuated hydraulically and wheel retraction can be accomplished in 4 seconds.

*(Continued on following page)*



***Front view of the twin-engined Beechcraft***

# PARTICULARLY IN AVIATION . . . IT PAYS TO BE PARTICULAR

After fifteen years of successful flying service operation, O. J. Whitney, Inc., has produced what is generally conceded to be the finest and most complete charter service in America. In conjunction with this, Whitney has developed a sales, service, student instruction, and rental business unexcelled in the East. This has been achieved through an earnest desire to serve satisfactorily discriminating individuals and organizations engaged in aviation.



RYAN S-T

Highly maneuverable, the beautiful Ryan has received unanimous acceptance in the East by dealers, pilots, and student pilots. Ideal for primary and advanced training and sports flying, this ship has proven popular beyond all expectations. On display at our exhibit at the National Aviation Show at the Grand Central Palace in New York. A few dealerships are still available. The Ryan S-T can be bought on time, but orders must be placed now for early spring delivery.



BEECHCRAFT

Combining a high economical cruising speed with low landing speed, the exceptionally high performance and comfort of the Beechcraft have won over one private owner after another. In the last eight weeks we have sold ten of these ships to owners who had previously been flying planes in the same weight class. A Beechcraft is also on exhibition at the National Aviation Show. By placing your order now you will not be affected by the increase in price coming soon. We have a few demonstrators for sale at greatly reduced prices.

**Visit our exhibit at the National Aviation Show, New York, January 28—February 6, and come out to our hangar at North Beach Airport to inspect ships, shop, and personnel.**

**In addition to Ryan and Beechcraft, we handle distributorships for Jacobs and Menasco motors, maintaining factory service equipment, and Stanavo products.**

# O. J. WHITNEY, INC.

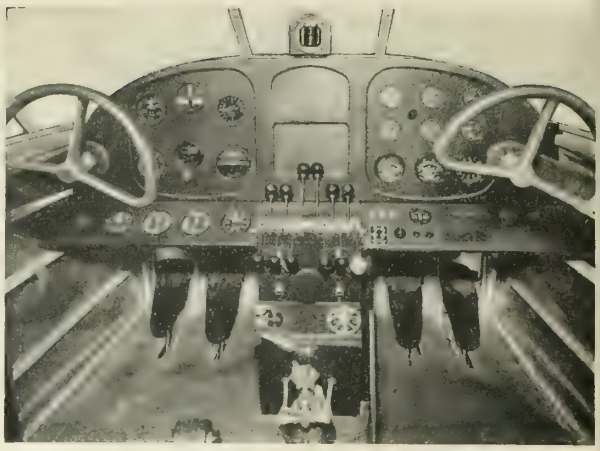
## FLYING SERVICE

NORTH BEACH AIRPORT JACKSON HEIGHTS, N.Y.

EST. 1922

*The finest Charter Service in America*





*Exterior of Beechcraft Model 18 during construction and view of the cockpit showing the roomy arrangement*

*(Continued from preceding page)*

Provision also has been made for manual operation of the landing gear and tail wheel.

The cabin is exceptionally roomy, having a length of 123 in.; height, 61 in., front, 53 in., rear; width 54 in. There is space for cupboard, desk or other items when the club interior arrangement is desired. Cabin soundproofing consists of Seapak with kapok felt used around openings in the walls. Ventilation (standard equipment) is controllable by the co-pilot, heat entering the cabin from ducts along the wall at the floor. Two baggage compartments are provided—one at the rear of the cabin, accessible in flight from the cabin, and the other built-in at the nose of the fuselage.

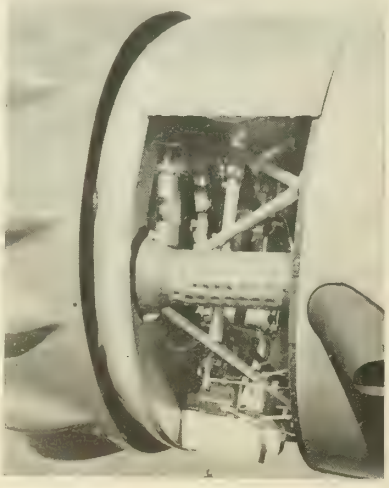
Pilots' compartment features a moulded non-movable safety glass windshield which not only improves vision in all directions but also enhances exterior lines at the nose. The two sections of glass are separated by a sheet of flat glass in the center of the windshield. A windshield wiper, moving parallel to the air stream keeps the center glass panel clear and insures vision in inclement weather, and for sleet formations, hot air ducts are provided to keep the glass free of ice. Individual dual wheel control is standard equipment, and pilots' seats are adjustable. Fire extinguishers located in both engine nacelles can be operated from the control board for either or both engines. A completely equipped instrument panel is arranged so that both radio receiver and transmitter are in the center position to eliminate remote control. By using a reel antenna and different crystals, it is possible to operate on a wide band of frequencies without inconvenience.

Throughout the design, attention has been given to simplicity of construction and ease of repair. In production it is possible to rivet large sections of skin to the stringers on the bench before assembly to the wing, stabilizer or fuselage, thus speeding the riveting operation and permitting mass production. Skin material throughout is 52S-H, a high fatigue and high corrosion resistant alloy. A modified head 53S-T high corrosion-resistant rivet is used throughout as these may be driven cold in the heat-treated condition.

Repairs to the engine mount and landing gear fittings may be made without endangering the heat-treatment of the steel spar.

Standard power equipment consists of two Wright R760E-2 engines having a total of 420 hp for cruising at 11,500 ft., and with 700 hp at 2500 rpm for take-off, or two Jacobs L-5 engines having a total of 420 hp for cruising at 8000 ft. and 600 hp at 2125 rpm for take-off. Fuel consumption for both makes of engines at cruising rpm is 35 gals./hr., and tankage is provided for 160 gals. of fuel in two 80-gal. tanks cradled between the engine compartment and fueslage on each side of the center-section behind the spar. With Jacobs engines, 8 persons, 479 lbs. of baggage, 125 lbs. of additional equipment and 96 gals. of fuel, cruising range is 465 miles. Four persons, 125 lbs. of baggage, 417 lbs. of additional equipment allow 210 gals. of fuel to be carried to give a range of 1000 miles. Cruising speed is 180.5 mph at 8000 ft.

*Accessibility of engine compartment*



Using the Wright engines and carrying 8 persons, 300 lbs. of baggage, 125 lbs. additional equipment and 96 gals. of fuel, range is 475 miles at a cruising speed of 185.5 mph at 11,500 ft.; four persons, 125 lbs. of baggage and 235 lbs. of additional equipment can be carried 1070 miles on 210 gals.

Standard equipment includes: Eclipse electric starters and generator, a 2-qt. fire extinguisher, position lights, first aid kit, log books, cabin lights, controllable-pitch propellers (with Wright engines) as well as the following. instruments: altimeter; compass; rate of climb; airspeed and turn and bank indicators; ammeter; oil temperature, oil pressure, fuel pressure, manifold pressure (with Wright engines) and fuel gauges; clock.

Specifications and estimated full load sea level performances of the new Model 18 Beechcraft are as follows:

Wing span.....47 feet 8 inches
Overall length.....31 feet 11 inches
Overall height.....9 feet 5 inches
Wing area.....347 square feet
Wing loading.18.7 pounds per square foot

| | Wright Engines | Jacobs Engines |
|---|---|---|
| Total horsepower .... | 420 | 420 |
| Total take-off power.. | 700 | 600 |
| Power loading (lbs./hp) ..... | 9.29 | 10.83 |
| Empty weight (lbs.). | 4100 | 3920 |
| Useful load (lbs.).... | 2400 | 2580 |
| Gross weight (lbs.).. | 6500 | 6500 |
| Cruising speed (mph) | 167 | 167 |
| Landing speed (mph) | 58 | 58 |
| Rate of climb (ft./min.) ..... | 1250 | 1200 |
| Service ceiling (ft.).. | 20,000 | 19,000 |
| Single engine ceiling (ft.) ..... | 8500 | 8000 |
| Cruising range (miles) ..... | 475-1070 | 465-1000 |

# NORTH AMERICAN AVIATION'S "BT-9" TRAINER

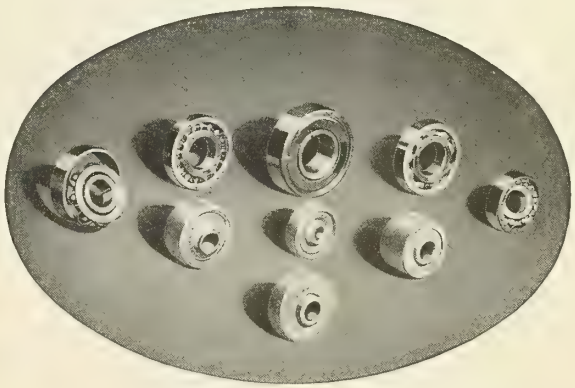
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PRECISION BALL, ROLLER, AND THRUST BEARINGS

# Practical Aspects of Radio Navigation of Aircraft

HENRY W. ROBERTS

● The purpose of this article is to outline the three basic methods of radio navigation of aircraft: radio range beacon system, aircraft radio direction finding, and ground radio direction finding—and to consider the practical aspects of radio navigation by means of each.

### Radio Range Beacons

The familiar radio range beacon system now in use was the first comprehensive radio navigation system for aircraft, and largely contributed to making American air transport second to none. Through the years its physical apparatus underwent many changes and improvements (as it will undoubtedly undergo in the future); but the principle of its operation remains essentially unchanged.

A radio range beacon provides, by means of a suitable antenna array, four paths, or beams, converging at the transmitting antennas and extending for a distance of about 200 miles. The exact direction of each beam may be varied by changes in the antenna arrangement, to provide directional guidance along the required route. In addition to the directional guidance, weather forecasts and airport information are broadcast, at prescribed intervals, on the same frequency; and low-power non-directional radio marker beacons along the airways provide positive position check. 133 such beacons form a closely-knit coast-to-coast network.

The only equipment the pilot needs to utilize this system is a radio receiver operating in the beacon frequencies (200 to 400 kc.).

Failure of radio navigational aids may lie in the air or on the ground. Assuming that the pilot is sufficiently experienced in instrument navigation of his ship by means of the radio range system, and that the range is functioning correctly, the only possibility which may lead to difficulties is failure to receive the signal. Aboard the airplane, this can only be caused by mechanical breakdown of receiving equipment; or a form of static (usually rain or snow static) may drown out the signal. With the high degree of maintenance usually furnished by the airlines, the former possibility is extremely remote. The nature of rain static and means of its elimination are now known (AERO DIGEST, Dec. 1936), and airlines are now equipping their fleets with electrostatically-shielded anti-static antennas.

The possibility of mechanical breakdown of the transmitting equipment on the ground is likewise remote, though occasional breakdowns inevitably occur. One of the causes may be found in the propagation of radio waves which do not propagate uniformly over a non-uniform terrain like the surface of the earth. They are "bent" by mountain ranges, by large masses of conductive matter (such as coal and ore deposits); they are absorbed, refracted and reflected, similarly to light rays. Furthermore, the dielectric potential of the ground varies with weather, distorting the radio wave front in an unpredictable manner. These changes in the wave front sometimes reach such proportions that the equisignal line of the range beacon may shift perceptibly. Those who have flown the range under various weather conditions know that the beacon behaves differently in bad weather, especially before a thunderstorm. Pilots who have flown over the Rockies report conditions of disappearing beams, and of "phantom beams" heard in the earphones where no beam ought to be. It is a safe guess that the beams lose as many pilots as the pilots lose beams.

These vagaries of the radio wave front, caused by changes in the earth's contour, nature of its terrain, and electrical conditions of the atmosphere, are entirely beyond human control, short of having the WPA pull down the mountains and redistribute the mineral wealth. This extraneous distortion of the wave front, usually called the "mountain effect," is inevitably present in any system of radio navigation.

It should be noted that the equisignal line may also shift as a result of a mechanical or electrical disturbance at the ground station. All beacons are periodically recalibrated to correct for a slight constant shift which occurs as the equipment wears out or gets out of adjustment; this slight shift, however, is seldom noticed by the pilots and is taken care of as a routine matter of maintenance.

### Aircraft Direction Finders

The art of radio direction finding is almost as old as radio itself. During the War, attempts were made to adapt radio direction finders for aircraft use, and large loops were wound between the wings of biplanes, to serve as a homing device. Considerable progress has been made

(*Continued on following page*)



*Typical aircraft radio direction finder (left)*

*Typical ground radio direction finder (right).*



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(*Continued from preceding page*)

since that time, particularly during the recent years, and the aircraft radio direction finders of today are, as such, extremely capable instruments.

What are their specific problems, and how do they fill the airman's needs?

Modern aircraft radio direction finders are all based on the loop principle: a vertically disposed loop is most responsive to signals lying within its plane, and least responsive to those at right angles to it. Between these two extremes, the responsiveness of the loop varies as the cosine of the angle between its plane and the direction of signal. The field pattern of a loop resembles an "8," from which it is apparent that a loop is critically sensitive directionally in its "null" position (at right angles to the direction of the signal, when no signal is received); while in its "maximum" position accurate directional sensitivity is lacking.

Many methods of utilizing these properties of loop antennas have been developed, ranging from ordinary homing devices capable merely of indicating the "on course" position, to complex navigating instruments automatically giving the bearing of the transmitting station in degrees, throughout the compass.

Despite these accomplishments, however, practical utilization of radio direction finding equipment offers obstacles in installation and operation.

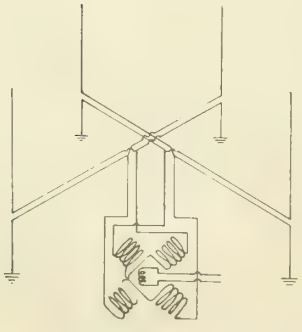
The electrical field of the airplane's structure is irregular, and the best that the radio engineer can do is to install his receiving antennas as close to the electrical center of the ship as possible, and note what correction is needed to compensate for the electromagnetic effect of the ship.

Insofar as rain static is concerned, although the loop is electromagnetically shielded, and therefore immune from its effects, the antenna used in conjunction with the loop is not, rendering the apparatus useless under rain static conditions. This does not hold true in the case of direction finders employing only electrostatically shielded loops.

The cardinal difficulty, however, lies in the actual application of an aircraft radio direction finder to navigational problems. The primary objection is the amount of attention its operation would require: to derive material value from the instrument, especially in commercial operation, a full-time radio operator would be needed aboard each ship.

In radio navigation of aircraft, too much emphasis is usually made on directional information. Knowledge of position is equally important. Merely pointing the ship towards a transmitting station does not simplify the navigational problem, but rather complicates it. Unless the course is corrected for drift, the ship will follow a curved path while heading towards the radio station. In flying such a curved path, the danger lies not in the longer distance covered (the flying time is almost the same as if the airplane flew a course corrected for drift), but in getting far off the planned route and encountering unexpected obstacles.

With direction finders capable of showing the bearing in degrees, it is possible to estimate the drift by comparing the radio course with directional gyro course; nevertheless, periodical position checks are imperative. The necessary manipulation of the instrument requires more time and attention than the flight crew can safely spare.



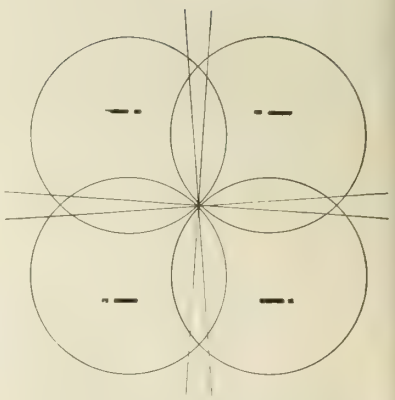
*Theoretical pattern of radio range beacon*




*Because of refraction of radio waves by shore line the radio wave travels from the airplane to ground direction finder along the line BCA, giving an apparent bearing ACD; the true bearing, AB, is not measurable*

The accuracy of the bearings obtained by mobile equipment is often insufficient for a definite position fix. The "mountain effect" is present, and is somewhat aggravated by the constant changes of the ship's position and altitude with respect to the earth's surface.

Furthermore, radio direction finders are affected by still another peculiarity of radio waves—the "night effect." The night effect is caused by a portion of the radio energy of the transmitter being reflected back to earth from the Heaviside layer. In aural reception, it is manifested by fading of the signals; in directional reception, the reflected sky wave strikes the loop obliquely and has the same effect on the indicating instrument as if the wave came from an off-course direction. With loops operating on the "null" principle, directional reception under night effect conditions is usually impossible; with loops operating on the ratio principle (measuring the ratio of signal induced in two loops disposed at equal and opposite angles about the craft's longitudinal axis), the night effect is materially reduced, being absent in direct "on course" bearings, but progressively increasing in lateral bearings.



*Schematic diagram of Adcock systems*

### Ground Direction Finders

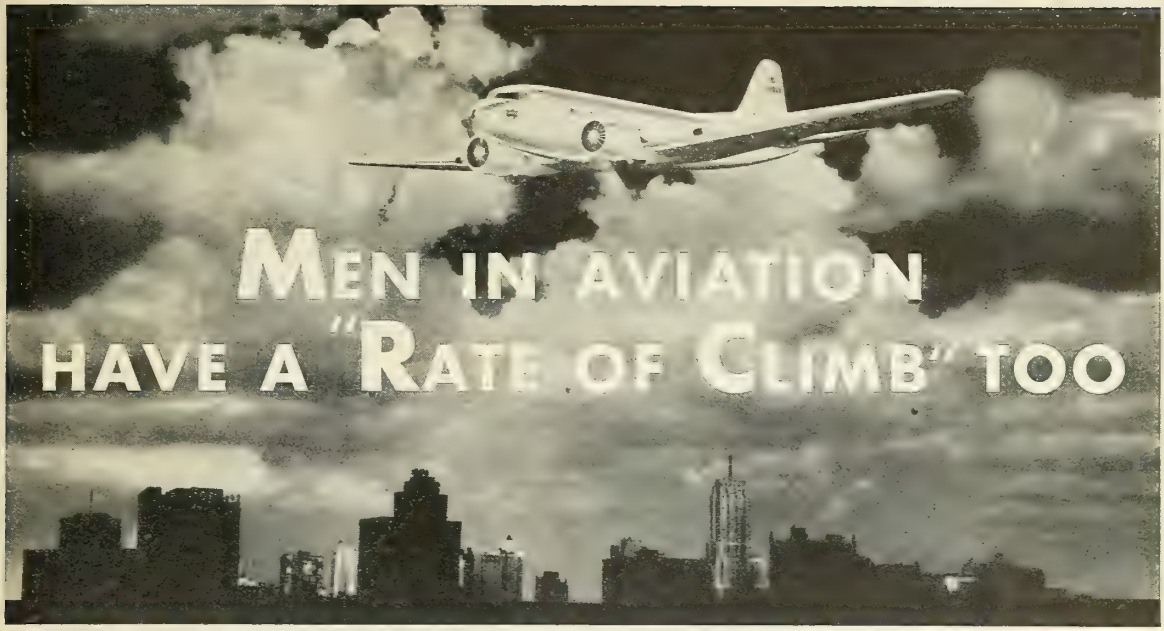
We will now examine means of navigating aircraft from the ground, by ground radio direction finding systems.

Here, the radio engineer is virtually unlimited in his selection of an electrically satisfactory site for his instrument; and being no longer limited by the physical dimensions of an airplane, he can make use of less compact, heavier, and far more precise equipment. From the start, ground direction finding equipment avoids those handicaps which beset the mobile equipment.

The paramount advantage of the ground system, however, lies in the fact that it takes the arduous burden of radio navigation from the busy flight crew, leaving them free to attend to the actual flying. Complex navigational problems are solved in the comparative comfort of the shore station, and the ship's position and bearing are computed and radioed to the pilot.

Several methods of direction finding from the ground are known, of which the Adcock system possesses the greatest accuracy, especially under night effect conditions.

This type of direction finding, augmented by several improvements designed to fill special needs, has been constantly and successfully used by American air lines in foreign commerce. At least a measure of this success can be attributed to the fact that the design, operation, maintenance and use of the equipment is under a single control.




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# STINSON RELIANT FOR 1937

● Refinements in design leading to better performance, and improvements in detail and appointments giving more comfort to passengers, are incorporated in the 4-5 place Stinson Reliant cabin plane for 1937, five models of which are available, under basic model designation SR-9.

Although similar in appearance to the 1936 model, the new Reliant shows a more fully streamlined fuselage shape due principally to changes in the windshield and cowl, and as a result of a more extensive use of fillets.

Comfort, convenience and styling feature the cabin design. The self-lighting, separate luggage compartment aft of the cabin has been enlarged and additional space under the seats provided. Two wide doors, long steps and fixed assist grips make entrance to the cabin easier. The rear seat, 52 in. wide (the same as in an automobile) accommodates three persons and in addition, the cabin has been lengthened to provide more leg room. Front and rear seat backs are higher and of the form-fitting type. Front seats fold forward and also are adjustable fore and aft, a new device enabling adjustment of the seats to three semi-reclining positions.

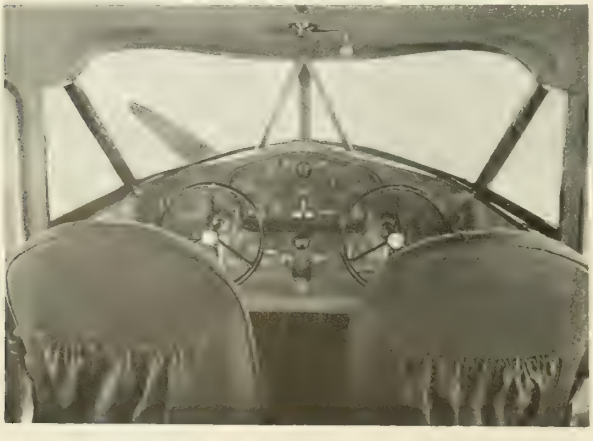
Safety glass is used throughout, and the windshield has been curved and rounded so that it not only reduces resistance to the airflow but also enhances the appearance of the airplane and improves visibility. Windows are longer and are of the roll-down type offering better vision both on the ground and in the air.

Advancements have been made in ventilation and soundproofing. In the new Reliant, cool air, under pressure, is led into the cabin from ducts in the wings, insuring pure air. Four air inlets are in the cabin and pressure and direction of flow, as well as temperature, are controllable. The air outlet is down and forward, thus pulling engine heat out of the cabin before it contacts passengers. When needed, cabin heat is provided through a heat resisting intensifier tube in the exhaust stack. In several models heat may also be directed into the carburetor bowl to break ice in the inlet throat or may be passed through tubes in the oil tank to warm the oil during cold weather.

Soundproofing has been accomplished by stuffing pads of porous fiber in the floor, forward wall between the engine and cabin, in the sides and headlining. These pads, together with dead air spaces, resist sound conductivity.

Fuselage construction, following standard Stinson practice, is all-metal tubing, fabric-covered. Structure of the gull-type wing consists of a girdered front spar of chrome molybdenum steel, doubled chrome molybdenum compression struts, dural rear spar, dural ribs and dural leading edge, all fabric-covered. Metal vacuum flaps, introduced by Stinson two years ago, are larger in area and are provided with slotted leading edges to give greater lift. Located close to the fuselage, these flaps do not interfere with positive aileron action and their action is controlled by a valve in the cockpit which provides practically instantaneous motion. Wing bracing is by steel torsion tubes, and struts are of streamlined dural tubing attached to the fuselage and wing by universal

*(Continued on following page)*





*Views showing the Reliant's automobile-type controls and luxurious appointments*



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(*Continued from preceding page*)
joints. Streamlining has been carried out by filleting at wing butts, wing strut boots, landing gear fairing and wheel pants.

Landing gear is the cantilever fixed type of wide tread equipped with Springdraulic (oil snubbed) shock absorbers, hydraulically-operated disc-type brakes and 8.50 × 10 semi low-pressure tires.

Controls are ball-bearing-actuated and an adjustable trim tab is mounted on the rudder. The stabilizer is adjustable from the cockpit by a micro adjustment control handle in the ceiling directly above the pilot. Auto-type dual controls, featured last year, have been retained. The right hand unit is removable. Rudder control pedals are dual and brakes are operated from the left pedal only.

Engine mounting is on a detachable unit, cushioned in rubber to dampen vibration and increase fuselage life.

Models in the Reliant SR-9 series are the SR-9B, with a 245 hp Lycoming engine and a Lycoming-Smith controllable-pitch propeller; the SR-9BD, a 245 hp Lycoming engine and a Hamilton Standard controllable-pitch propeller; the SR-9CD, 260 hp Lycoming engine and Hamilton Standard controllable propeller; the SR-9DD, 285 hp Wright Whirlwind engine with Hamilton Standard controllable propeller; and the SR-9ED, 320 hp Wright Whirlwind with Hamilton Standard controllable propeller. Pitch of the Lycoming-Smith blades is changed electrically from the cockpit, and of the Hamilton Standard blades by hydraulic action, also controlled from the cockpit. Each engine is equipped with Scintilla magneto, Stromberger carburetor and Eclipse electric starter. Models SR9CD, SR9DD and SR9ED are equipped with 15 amp. motor-driven generators as standard equipment.

Flight instruments are mounted in rubber in an indirectly-lighted instrument panel. Model SR-9B is equipped with Kollsman compass, altimeter, airspeed indicator, tachometer, engine oil pressure and temperature gauges. All other models have, in addition to the above, bank and turn and rate of climb indicators, manifold pressure and carburetor air temperature gauges.

Performances, varying with the different power-plant and propeller installations, show cruising speeds (at critical altitudes) ranging from 143 mph to 161 mph, landing run (with flaps) from 250 ft. to 290 ft., cruising range from 615 to 650 miles and rate of climb from 800 to 1050 ft./min. Gross weight varies from 3700 lbs. to 4050 lbs., and range of useful load is from 1220 lbs. to 1410 lbs. Tankage for 70 gals. of fuel is provided in some models; in others provision is made for 80 gals.

# The New Rearwin SPORTSTER



● The Rearwin Sportster for 1937, while basically similar to last year's model, incorporates many refinements in design leading to better performance.

Available in three types—the Model 7000, Model 8500, and Model 9000—the new Sportster shows more streamlining and more attention to detail.

In exterior appearance care is evidenced in the covering, the finish having several more coats of clear and pigmented dope. Speed stripes down the side of the fuselage are outlined in gold, and all exposed aluminum parts, including the cowling, have a baked enamel finish.

Lines of the turtledeck harmonize better with the design and an extra bulkhead has been added to improve the foundation for the covering.

All models have been equipped with roller bearing wheels and tires are larger, giving smoother landings. A larger, more streamlined and stronger fin has been designed as has a new elliptical wing tip which is available on special order. Double elevator horns previously used have been replaced with a single horn concealed in the tail fairing. Aileron controls on standard models also have been changed so that they are more responsive, the change including newly-designed streamlined horns.

To improve streamlining and increase performance, the front fairing and cowling has been redesigned so that now these are more rounded. New models also incorporate longer travel landing gears, and longer and heavier springs for taxiing on rough fields.

Deluxe models have a ball-bearing system with most of the controls concealed beneath the floorboard to give more cabin room. The rear seat in these models is hinged so that it can be raised to allow carrying a Gladstone bag in a 20 × 29 in. compartment underneath it. Additional baggage space is provided in a compartment in the turtledeck.

Other design improvements are seen in the new propeller with its spinner, and in the 6" pneumatic tail wheel which is of the hinged shock absorber type.

Improvements also have been made in the LeBlond engines which power the 7000 and 8500 models. These engines, of 70 hp and 90 hp respectively, now have three main bearings instead of two, and are equipped with shielded magnetos, thus facilitating installation of radio.

Interior appearance is enhanced by the use of a baked crackle-finish instrument panel provided with matched Aeromarine instruments, and space for the radio dials. The map rack, placed below the instrument panel, has been cut back several inches to give more room in the cabin. Seat cushions are finished in mohair. Two sliding windows permit individually-controlled ventilation and green pyralin overhead eliminates heat and glare. As before, seats are arranged in tandem with dual controls.

Rearwin Sportsters are approved for 2 persons, 24 gals. of fuel, 50 lbs. of baggage and an additional 50 lbs. for extra equipment. Models 8500 and 9000 (90 hp Warner engine) are also approved for Edo float installation and all three models are approved for Eclipse electric starters. For winter use, Sportsters may be equipped with a hot air cabin heater controlled from the instrument panel.

Maximum speed ranges from 115 to 123 mph, cruising speed from 103 to 110 mph and rate of climb from 625 to 1000 ft./min. Range is 500 miles and landing speed 38 mph.




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# Digest of Technical Articles from Foreign Publications

### Aerodynamics

*Theory of the Slat in a Two-Dimensional Flow. Prof. V. V. Golubev, Text Translater from the Russian and Edited by J. R. Crean, B.Sc. (Eng.), The Journal of the Royal Aeronautical Society, No. 309, September,* 1936.

Treating a subject of great interest and importance, this translation attacks the problem in its fundamental aspects:

(a) Determination of the conditions under which begins the breakaway of the streamlines from the upper surface of an airfoil; and (b) determination of the influence of the slot on those conditions. Part II of the paper, treating the fundamental problem stated under (a) is particularly instructive at this time and instead of reviewing the paper as a whole, extracts are given here.

"When an airfoil works under conditions of an entirely streamline flow the point of breakaway of the streamlines is situated at the trailing edge. The theoretical deduction concerning the law of pressure variation is in sufficent measure confirmed by experiment which, in addition, reveals the interesting fact that even when the point of breakaway is displaced from the trailing edge an approximately linear distribution is obtained throughout the interval between the point of minimum pressure and the point of breakaway.

"In the case of airfoils of thin sections ($t$=.05) the point of breakaway of the streamlines upon leaving the trailing edge is displaced very rapidly along the upper surface, so that, with a very small increment in the angle of attack beyond the limiting angle, the airfoil commences to work wholly in a discontinuous flow, a marked diminution in lift and increase in drag being necessarily concomitant to this. By increasing the thickness of the section, the rate of displacement of the point of breakaway . . . is slowed down and therefore the deterioration in the efficiency of the airfoil . . . takes place comparatively slowly."

### Airports

*Airports (Aeroporti; Ing. Vicenzo Gillardi; Rivista Aeronautica, N. 10, Ottobre, 1936).*

Airports are assuming an importance which is properly due them. The first chapter of this article is devoted to the factors to be considered in airport location the paramount of which, in the author's opinion, is dictated by meteorological conditions. He analyzes further the shape of the airport, going into a lengthy discussion of proper coordination of layout with performance characteristics of the operating aircraft. Subsequent chapters treat the subject of runway surfaces, drainage, buildings, hangars, seaplane bases, illumination, signals and marking. The author gives seven references, the three in English being AERO DIGEST, Donald Duke (*Airports and Airways*) and Stedman S. Hanks (*International Airports*).

### Flight Testing

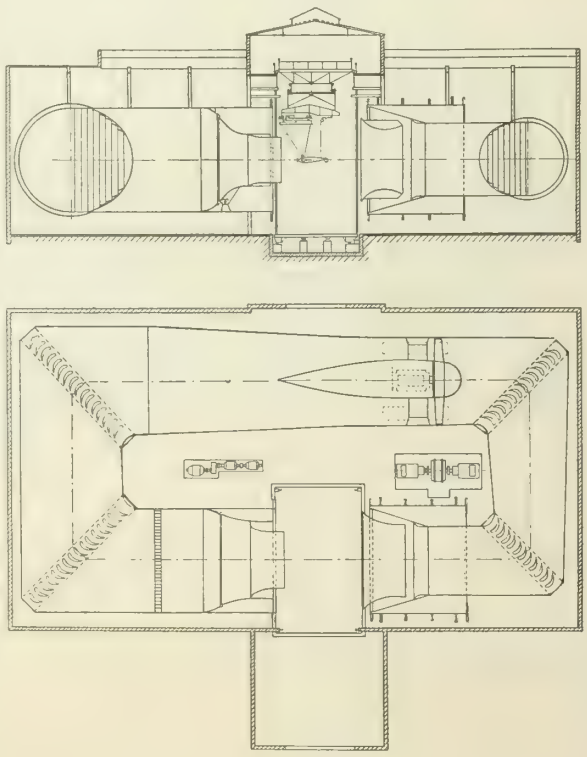
*Morane-Saulnier Automatic Force Recorder, Revue de l'Armée de l'Air, N. 83.*

The apparatus consists of three parts: (1) column force units, (2) rudder pedal force unit and (3) register unit. Forces are measured by manometer units in pairs located in two mutually perpendicular planes, providing not only a determination of the magnitude of the force but of the direction as well. While the apparatus is comparatively simple and adoptable for use in private factories, its only drawback lies in the necessity of installing special control assemblies—an undesirable feature from the viewpoint of an industrial flight section unit.

### Vibrations

*Experimental Research on Flexural-Torsional Vibrations of a Wing Model with Variable Rigidity (Ricerche Sperimentali sulle Vibrazioni Flesso-Torsionali di un Modello di Ala con Rigidezze Variabili; Placido Cicala; Atti della Reale Accademia delle Scienze di Torino, Vol. 71, 1935-36—XIV).*

This paper presents the results of a series of tests performed at the Royal Superior Institute of Engineering, (Turin) to determine the critical velocity, frequency and form of oscillations on a model wing at different angles of attack and for various combinations of flexural and torsional rigidities. It was found that there is a marked influence of the angle of attack on the critical velocity. Tests with and without the wind indicated considerable differences in periods and forms of vibration due to this factor. One of the important conclusions reached by the author is that at negative angles of attack there is a marked decrease in critical velocity.



*Plan and section of Gottingen variable density wind tunnel*

### Flight Testing

*Maneuverability Tests and Instruments (Essais de Maniabilité et Instruments; Fr. Hans; L'Aeronautique, No. 209, Octobre, 1936).*

Present demands of comfort and safety necessitate an evaluation of control and stability characteristics rather than an acceptance of qualitative generalities of a test pilot. This fact has become generally recognized and has been used for some time in France, England, Germany and Russia. The author describes in this article a new apparatus devised by M. Bonny and intended to give a continuous and simultaneous record of a number of variable essential for complete determination of flight path, velocities, accelerations, etc. The unit appears to be comparatively compact, and its automatic feature and continuous record make it particularly suitable for the purpose. The article includes a description of some of the results obtained with this equipment.

### Propellers

*A Graphical Method of Calculating the Performance of an Aircrew. By C. N. H. Lock, M.A., of the Aerodynamics Department, N.P.L. Air Ministry (Great Britain); Aeronautical Research Committee; Reports and Memoranda No.* 1675, *October* 25, 1934.

A rapid method is described of propeller performance analysis by means of charts. The first application is to ordinary strip theory calculations. Six charts are required for each radius for which the value of thrust grading, etc., are to be derived; of these, four depend on the number of blades but are otherwise universal, and the remaining two charts involve the lift and drag curves of the section.

The second application gives considerable further simplification in that the charts are required only for a single standard radius (0.7); the thrust coefficient corresponding to a given working condition can then be deduced by a simple operation with three charts while the torque involves three further charts and a simple addition.

An analysis of the results of wind tunnel tests shows that the method will give reasonably consistent results over a pitch ratio range from 0.3 to 2.5, although there is little doubt that the method will cover the range of blade width likely to occur in practice. Changes of blade section and also of planform and twist may be allowed for if necessary by modifying the lift and drag curves. The second method is also applicable to the stalled range of a propeller.

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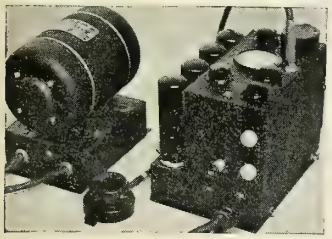
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* * * *

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● The New Aeronca **begins** where most other light planes **stop.** It embodies mechanical advances and engineering refinements heretofore confined to cabin planes selling at $6,000 and more. It has the sleek streamlines of the modern transport plane.

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● A full description with complete specifications of the New Aeronca will appear in this magazine next month. Watch for it! ● On display at the Grand Central Palace, New York. The 1937 Warner-powered Low Wing Aeronca is on the field for demonstration.

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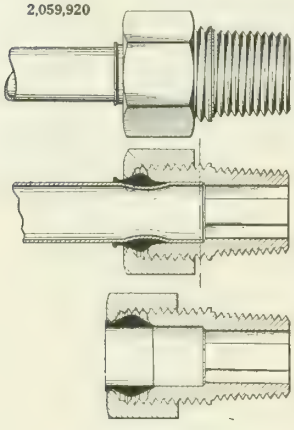
# Recent Aeronautical Patents

● The following recent patents of interest to readers of AERO DIGEST were compiled from the Official Gazette of the United States Patent Office.

Internal combustion engine. Allan R. Wurtele, New Roads, La. (2,059,720)

Compression fitting. Albert J.

2,059,920



Weatherhead, Cleveland, Ohio, assignor to The Weatherhead Co. (2,059,920)

Azimuth circle. Burton M. Green, Brooklyn, N. Y. (2,059,944)

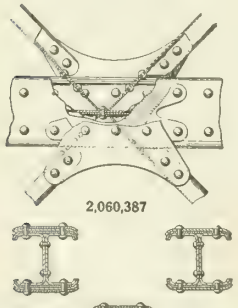
Windshield defroster. Theodore J. Gerwer, West New Brighton, Staten Island, N. Y. (2,059,990)

Aircraft. Holman Stanley Hinkson, Lacytown, Georgetown, Demerara, British Guiana. (2,060,077)

Fuel pump for aircraft engines. Frederick W. Heckert, Oakwood, Ohio. (2,070,209)

Spark plug and method of making same. Armen A. Kasarjian, Jackson Heights, N. Y., assignor to Mosler Ignition Corp. (2,060,219)

Aircraft body structure. Barnes




Neville Wallis, Weybridge, England, assignor to Vickers (Aviation) Ltd. (2,060,387)

Internal combustion engine. Frank A. King, Los Angeles, Calif. (2,060,221)

Sound absorbing structure. Theodore M. Prudden, Hingham Center, Mass., assignor to Pacific Mills. (2,160,241)

Magneto generator. Walter J. Spengler, Sidney, N. Y., assignor to Bendix Aviation Corp. (2,060,259 and 2,060,260)

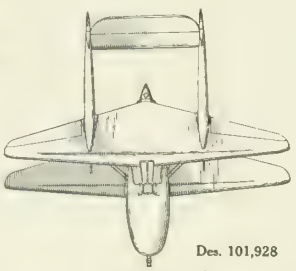
Airship. William N. Noble, New York, N. Y. (2,060,469)

Fuel control means for airship engines. John H. Smith, Meadville, Pa. (2,060,536)

Compass. Francis West, Jr., Chilmarks, Mass., assignor to Paul Zuckerman. (2,060,766)

Aircraft intercommunication system. Gurney L. Hunt, Washington, D. C.; Mabel L. Hunt executrix of said Gurney L. Hunt, deceased. (2,060,806)

Design for a tandem motored




biplane. Roscoe C. Wilson, Fairfield, O., and Oscar Swanson, Santa Monica, Calif. (101,928 design)

Air velocity meter. John R. Boyle, Chicago, Ill., assignor to Illinois Testing Laboratories, Inc. (2,060,848)

Airfoil wire. Louis W. G. Flynt, E. Orange, N. J., assignor to Breeze Corp., Inc. (2,060,859)

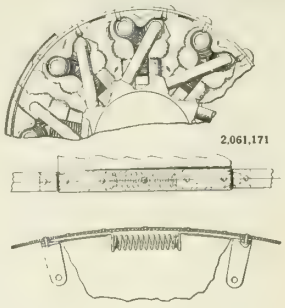
Rotary engine. John N. Hinckley, Cambridge, Mass., and Stanley H. Clark, Provo, Utah. (2,060,937)

Aircraft. Severyn I. Molicki, Denver, Colo. (2,060,946)

Airship. Martin Jelalian, New York, N. Y. (2,061,075)

Automatic ignition cut-out for gas engines. Ralph D. Lacoe, San Diego, Calif. (2,061,078 and 2,061,079)

Cooling means for air-cooled




internal combustion engines. Earle A. Ryder, W. Hartford, Conn., assignor to United Aircraft Corp. (2,061,171)

Built-up rotor for gyroscopes. Hollis Walter, Baldwin, N. Y., assignor to Sperry Gyroscope Co., Inc. (2,061,261)

Machine gun and attachment therefor. Frederick T. Moore, W. Hartford, Conn., assignor to Colt's Patent Fire Arms Manufacturing Co. (2,061,313)

Commutator truing mechanisms. William S. Green, Waukesha, Wis. (2,061,398)

Clip member. Charles L. Hall, Detroit, Mich., assignor to United-Carr Fastener Corp. (2,061,463)

Fastener secured installations and fasteners for the same. Arthur W. Kimbell, Newton Center, Mass., assignor to United-Carr Fastener Corp. (2,061,467)

Riveted structure and method of making the same. Louis C. Huck, Grosse Pointe Village, Mich., assignor to Huxon Holding Corp. (2,061,628)

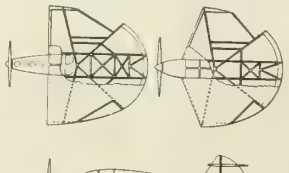
Parachute for airplanes. Benjamin Slipikas, Brooklyn, N. Y. (2,061,640)

Dirigible aircraft propulsion and control. Wellington B. Wheeler, El Segundo, Calif., assignor of one-half to Florence E. Gaines. (2,062,018)

Centrifugal governor for internal combustion engines. Paul Belyavin, London, England, assignor to Belfrost Diesels Ltd. (2,062,084)

Loop antenna. Edward J. Hefele, Amityville, N. Y. (2,062,129)

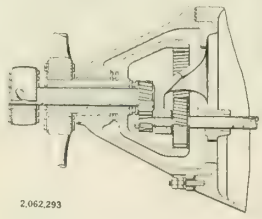
Aircraft. Cloyd L. Snyder,




South Bend, Ind. (2,062,148)

Gas tank safety valve. Cyrille Gielen, Sr., W. Paterson, N. J. (2,062,218)

● Propeller drive. Denis F. Cash-




man, Dayton, Ohio. (2,062,293)

Face mask. Frank G. Manson, Dayton, Ohio. (2,062,325)

Seaplane pontoon. Loren Jay



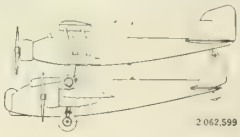

White and Clarence W. Munn, Milwaukee, Wisc., assignors of one-fourth to D. M. Huelsbeck. (2,062,384)

Screw. Frank K. Brown, New




Bedford, Mass., assignor to Continental Screw Co. (2,062,550)

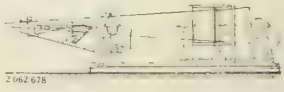
Airplane. John Dudley North,




Eaton, Norwich, England assignor to Boulton Paul Aircraft, Ltd. (2,062,599)

Piston. Allen B. Norton, Cleveland, Ohio, assignor by mesne assignments to The Cleveland Trust Co., trustee. (2,062,625)

Airplane instruction device.




George Rockwell, Fanwood, N. J. (2,062,678)

Cylinder construction for air-cooled internal combustion engines. Charles S. Brown, Syracuse, N. Y. (2,062,391 to and including 2,062,394)

Aircraft advertising, and method for creating aerial effects. John C. Haddock, Wilkes-Barre, Pa., and Zantford D. Granville (deceased), Springfield; Alta M. Granville, administratrix of Z. D. Granville. (2,062,510 and 2,062,511)

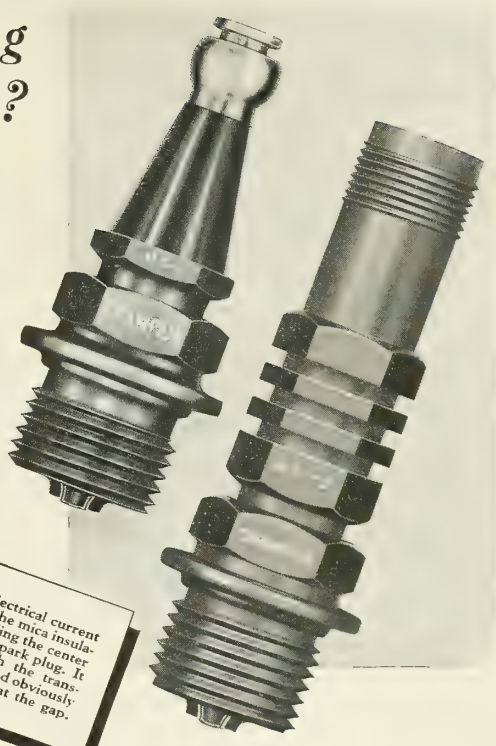
# *Is* **CORONA*** *impairing your spark plug performance?*

Here is a simple test anyone can make to determine the presence of corona in mica aircraft spark plugs.

Remove the core from the plug and place it with its firing tip 3/16″ away from a grounded point. The spark is jumped across this 3/16″ gap, either coil or magneto being used as the source of current. The test should be made at atmospheric pressure. If corona is present it can be seen as a streak of light *inside* the mica washers which form the core. It is obvious this leakage impairs the spark at the gap.

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* Corona is electrical current leakage within the mica insulation and paralleling the center electrode of the spark plug. It is visible through the translucent mica core and obviously impairs the spark at the gap.

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|---|---|---|
| 27 | HORNET A-1's—525 H.P. ..... | $500 |
| 18 | HORNET B's—575 H.P. ..... | 850 |
| 25 | WRIGHT R975's—330 H.P. ..... | 675 |
| 40 | CURTISS D-12's—400 H.P. ..... | 500 |
| 18 | CURTISS CONQUERORS — 600 H.P. ..... | 500 |
| 3 | AXELSONS—150 H.P. 7 cylinder, air cooled ..... | 150 |
| 1 | CHALLENGER—185 H.P. ..... | 195 |

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# AERO *RADIO* DIGEST

## Newest Developments in the Field of Aircraft Radio

### Radio Meteorgraph

Tiny balloons with equipment which records weather data and automatically radios it to ground stations are now being sent up into the stratosphere in a series of experimental flights supervised by the national Bureau of Standards in co-operation with the U. S. Weather Bureau, to collect data for long-range weather forecasting. It is hoped that it will be possible to forecast weather two weeks in advance, instead of the present 24 to 48 hours.

Radio messages transmitted by the midget radio apparatus can be heard when the balloons are 25 miles above the earth and 80 miles distant from the ground station.

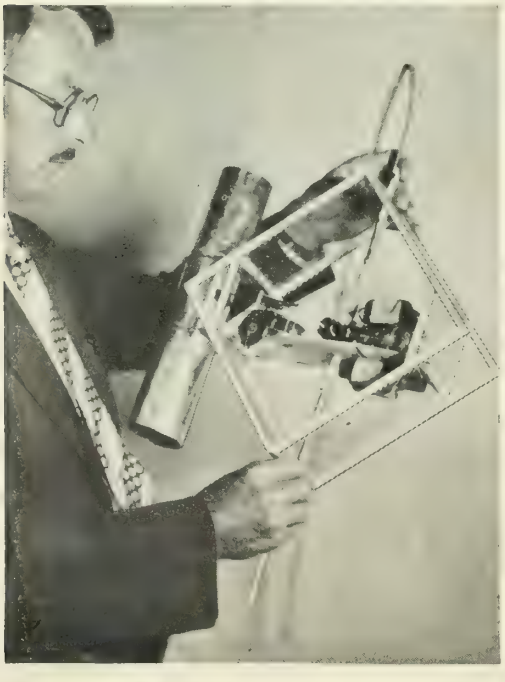
Recording and transmitting mechanism is mounted on a light wooden frame and protected by cellophane; the thermometer, outside the frame, is shielded from direct sunlight by a long tubular structure. At a height of ten miles the average temperature was found to be —70° C. (—94° F.). When the balloon reaches its maximum elevation, it bursts, and the apparatus is lowered to earth by a small parachute. The cost of the equipment is so small that it is not necessary to retrieve it for subsequent re-use.

The problem of making a lightweight battery was solved by the National Carbon Co., which developed for this purpose an extremely minute "B" battery. The battery produces 45 volts, stands 2 in. high and weighs 2 oz. Reduction in battery weight has not only lowered the cost of the balloons to a figure where their use is practicable, but has also made possible ascensions to higher altitudes. The entire balloon equipment now weighs less than 20 oz.

It is possible that such balloons may replace the airplanes now being sent up daily at twenty upper-air stations for weather observation. Cost of gathering data by balloons would be less, and the balloons would attain much greater heights than those possible with an airplane.

Fifteen experimental flights have already been made from Omaha, and others are being planned, including one from Atlantic City, N. J. Work is being conducted under the direction of Dr. L. F. Curtiss, of the United States Bureau of Standards.

*Radio meteorgraph in cellophane-enclosed structure*



### Refinisher

Refinishing and undercutting generator commutators can now be easily done by a new machine manufactured by W. S. Green Engineering Co.

Head and tailstock centering chucks allow armatures to turn on their bearing surfaces as when replaced in the generator, permitting the commutator to be machined concentrically with the bearing surfaces. With the aid of this machine, a commutator can be trued up and refinished in about five minutes. The manufacturer also offers another machine for mica undercutting.

### Directional Antenna

The new American Airlines directional communication antenna bids well to reduce traffic congestion in aircraft radio by eliminating relayed messages between ground stations along the line's 3000-mile route.

Installed at Grand Central Air Terminal, Glendale, it can flash code messages across the continent, and has a 500-mile range for voice communication. The antenna is trained on a point midway between New York and Fort Worth, and because of its directional characteristics will provide maximum radiation substantially along the airline's route, obtaining greater range for a given power and avoiding interference with communications elsewhere.

The loop employs a coaxial transmission line feeder system—an expensive but highly efficient method of transferring power from transmitter to antenna. The center wire, supported by isolantite beads, is carried coaxially within a copper duct, the surrounding atmosphere serving as the major insulating medium. Ordinary air, however, because of moisture and temperature variations, is not a stable insulator, becoming slightly conductive under certain weather conditions. The duct, therefore, is filled with nitrogen gas under pressure, and sealed, providing excellent insulation.

Frequency changing is accomplished by a motor-driven multiple switching unit. This unit, remotely controlled by a telephone dial system, drives a single insulated shaft mounted vertically in the center of the transmitter.

Tuned circuits are used throughout, and turnable air dielectric condensers replace conventional fixed units in the higher power stages. Frequencies may be accidentally varied, with all voltages applied, without damage to the equipment.

An unusual method of keying and press-to-talk control is used. A fixed oscillator generates a 4100 cycle signal, which activates tubes at the transmitter control unit. These tubes control a relay to turn on the high voltage when phone is used; or allow the application of screen voltage, supplied to the doubler and intermediate stages, when keying. This eliminates many relays, and keying can be followed regardless of speed; this feature also permits the use of facsimile speeds.



*American Airlines' directional communication antenna*



*Robert Cummings and his green Porterfield airplane, "Spinach".*

## SEE THE PORTERFIELD EXHIBIT AT THE NEW YORK SHOW—JAN. 28TH—FEB. 6TH

★

**Robert Cummings, Paramount star, the proud owner of a Model 70 Porterfield with 70 hp LeBlond engine, says:**

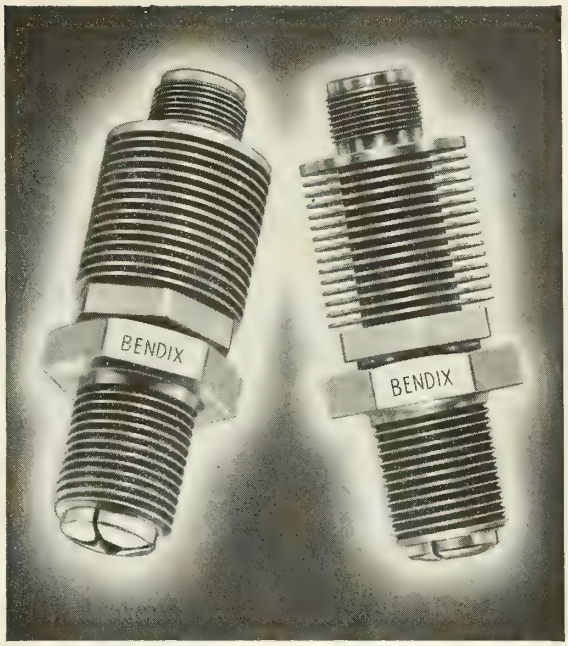
"Since I received the Porterfield I have taught three people to fly it. One has soloed—my wife and another old friend are near that experience. Flying 'Spinach' is about as restful as anything I can imagine. I wish to compliment you and your entire organization on the amazing performance, dependability and economy of this big little aeroplane. You claimed a cruising speed of 105—my ship cruises 110 at 1750 revs."

Robert Cummings is one of the many satisfied Porterfield owners.

**Five models in these outstanding low-priced airplanes are available from $1,295 to $2,895. One-third down—twelve convenient payments.**

**PORTERFIELD AIRCRAFT CORPORATION**

**2457 Charlotte Street** **Kansas City, Missouri**




*Announcing*

**THE NEW**

# BENDIX-SCINTILLA *Aircraft* SPARK PLUG

**for latest type high output engines**

●

SCINTILLA MAGNETO CO., INC.
(Subsidiary of Bendix Aviation Corporation)
SIDNEY, NEW YORK

# Personalities

by Caldwell

● Clare W. Bunch is president, general manager and sales manager of Monocoupe Corp. of Robertson, Mo., thus running in three sections at the age of 33. That is not only satisfactory to Mr. Bunch, but surprising to an observer of aviation, a business, science, art or didoe where the average pilot's career is best exemplified by studying the peculiarities of kittens and lobsters: the kitten spends part of its career furiously chasing its tail and going no place in particular, while the lobster thoughtfully walks backward. If that doesn't describe the average pilot's life, I don't know what does. It was when I had reached the backward-moving stage of my own career as a pilot that I turned to writing, a task that reminds me of that performed by the humble tumblebug, who selects a ball of manure and pushes it ahead of him to some unknown destination. I sometimes wonder how long the bug and I can keep it up—we've been at it for years.

Last month I wrote up an old pilot who had sunk to selling aircraft accessories, and another member of the trade wrote in to inquire sarcastically if my "palm had been crossed with cash" for giving that patient struggler in the marts of trade a free advertisement. The answer is no, unfortunately—nobody pays me for these little sketches but the publisher, who deducts the amount paid from his income tax, under the heading of charity. The only time any cash was ever mentioned by the subjects of these sketches was years ago, by that old bull moose of aviation, Pop Cleveland. After reading what I had written about him, Pop remarked sadly that he would cheerfully have paid any reasonable amount to have me *not* write about him. I believe Gene Vidal feels the same way, and probably old Charles Horner, President, for no discernible reason, of the NAA. In fact, there are so many people in aviation who would prefer me to not mention them, that I believe I could make a fair living by simply agreeing not to write about them. However, no amount of money would induce me to forego the pleasure of writing about such *animalculae* as infest the Department of Commerce, so to please myself I must eschew such non-writing income, and continue to roll my little ball of comment ahead of me—just another happy tumble-bug.

The Monocoupe Corp. of which Clare Bunch holds all offices except the office boys', produces the famous Monocoupe and the new twin-engined Monocoach, as you undoubtedly know. The Monocoach is Clare's own idea, mostly. For several years the idea of a small twin-engined ship for the private owner had appealed to him, and he had devoted much time and consideration to the project. Accordingly, in the summer of 1935 his company began working on a ship of that type. Actual construction was started on January 1, 1936, and on July 11 the Monocoach was flown. A few days later, when Clare was flying it around the country collecting bugs and prospects, he landed at Roosevelt Field and gave me a fine flight in the ship, even turning the controls over to me and letting me amble it around a few corners in my feeble, old-fashioned way. The plane really flies itself, and the most helpless semi-pilot will find himself in no difficulties. I believe that even John Giesse or Dick Blythe could trust themselves to the Monocoach and have it take them around and land them again safely into the wind without damage,—unless they absolutely fought with it and forced it to fly *their* way.

Clare does most of his own test flying. Through his engineering and flying experience he is well prepared to know what is desirable in flight characteristics, comfort, and all those things that go to make up a fine ship for the private owner. (*Free* Advt.)

The ship lands equally well with the wheels up or down. As is sometimes customary with retractable landing gear ships, the wheels-up test was made inadvertently last August, when Clare forgot and set the ship down on his home airport for a beautiful belly landing, the only damage resulting being two bent propellers and the bent pride of the test pilot, who by now has recovered from a bad case of mortification and chagrin. He now has a warning device, guaranteed to work, even if it has to bang the pilot over the head to remind him.

Bunch had his first flight in 1923, when Dan Robertson of St. Louis took him up. That so unsettled him that he determined to make aviation a career, connecting with Pioneer Instrument Co. in June, 1928, in the Field Service Department on what was then Curtiss (now Roosevelt) Field. The department was in George Wiess' hangar, and the staff consisted of Bunch and Bill Eddy, who once compensated a compass for me in a Fairchild, telling me that the cabin had been very dirty and that they, kind and generous souls, had cleaned it for me out of pure kind heartedness and friendship. I thanked them profusely for this favor and went to the ship to discover that after cleaning it they had left it outside with all the windows open, and a mechanic running up another machine had blown back into the cabin just about 50 pounds more dust and dirt than Bunch and Eddy had cleaned out of it. When I complained bitterly at this thoughtlessness and demanded a re-cleaning, Eddy grumbled that this was the last time, so help him, that he'd ever try to do anyone a favor. He declared that even with its new load of grime, the cabin still was cleaner than it had been before he and Bunch had cleaned it. But that was a libel. I cleaned that ship regularly—every August.



*Clare (Monocoupe) Bunch*

For the next year Clare Bunch worked in the engineering and experimental departments, and the production and sales departments of Pioneer, going to Wichita in 1929 to open a branch office in what was then known as the Air Capital of the World, because Walter Beech and Clyde Cessna lived there. When Bunch arrived there were 16 different airplane companies listed in the telephone directory; some were in operation, as they had been for years, others were starting, when suddenly the New Era in finance turned out to be not so new and not so hot. The Panic was upon us by fall. I was working out of Wichita myself then, ferrying Cessnas for Clyde, and wondering to what new lows Allegheny Steel, Bethlehem, General Motors, and Monkey-Ward were heading —for I had little bits of all of them and was rapidly being whittled down from a small capitalist to an even smaller proletarian. I can laugh at it now, but it was months before I could manage a smile in 1929 and '30. That turned me permanently against Hoover, not that I blamed him for the depression, but because he kept putting out optimistic statements about the immediate future—and whenever he made one of those predictions, my stocks slumped another five points. All Hoover had to say was, "Things are looking better," when everything went and hit a new low. And I feel exactly the same way about Roosevelt's New Deal as I used to feel about Hoover's New Era and his two chickens in every bed-room, or whatever his slogan was. And speaking of Dr. Roosevelt, I see that recently, in discussing unemployment, he called upon business to "absorb" more of the unemployed. Why, that's what Hoover used to call for! It's taken Mr. Roosevelt some time,

but at last he's right back where Hoover was in 1930. Our government today is Fascism in a Mother Hubbard wrapper. Where was I?—ah, Bunch.

Bunch and Wichita and me—we both got starved out of there eventually. I delivered the last Cessna to Curtiss-Wright, who were storing them in hangars upon arrival—and by 1931 Charlie Colvin got wind of the depression and abolished the Wichita office, and Bunch. By that time Clare had acquired a J-5 Travel Air, which he proceeded to barnstorm, arousing practically no excitement, and no money. Money had been abolished, too. Times were so tough that people wouldn't accept rides for nothing, fearing the wear and tear on their pants. People stood up all the time to save getting a shine on the seat of their last blue serge suit. And right about then foreign nations stopped paying the eight bucks apiece they'd been paying us each year on their war debts, leaving Rockefeller, Mellon, and E. L. Cord to bear the brunt of taxation on their shoulders. For a time Donald Douglas had to lay up his yacht and use the street cars, while Rube Fleet emigrated in a covered wagon from Buffalo to California, passing on the way the bleached skeletons of several small airline operators who had perished in the drought. No wonder the proletariat called for a change of rulers—like the frogs in Aesop's fable who got tired of King Log and got King Stork.

Clare Bunch, the discouraged and unfed barnstormer, finally gave up and went home to the Ozarks—I forgot to tell you that he was born in Linn Creek, Mo., on March 18, 1903. Linn Creek was located in the Ozarks of South Central Missouri, 20 miles from the nearest railroad, and that one a jerk-line of the jerkiest. There are millions of people who never heard of Linn Creek, and now if they want to see it, because the famous Mr. Bunch was born there, it's too late. In 1927 a power company built Bagnell Dam across the Osage River and formed an artificial lake, 125 miles long, known now as the "Lake of the Ozarks." The town of Linn Creek is 50 feet under water. On clear days you can fly over it and see the little fishes swimming in and out of the First National Bank, and also the flour mill and the lighting plant which Clare's father used to own in the old days. If they ever decide to erect a memorial to Bunch in the town where he was raised, they'll have to make it a buoy, anchored over the spot and hooting mournfully on stormy nights, like a vacuum-cleaner salesman whistling to keep his courage up.

Clare located in Camdenton, built to take the place of sunk Linn Creek, cleared off the top of a hill, made a little airport, put up a hangar, and settled down to outlast the depression by selling Chevrolets. He had been in the Coast Artillery Reserve Corps—the Coast Artillery being the most useless of all our defense forces—but in 1932 he transferred to the Air Corps Reserve and obtained a pilot rating, so he could do something in a war beside sit and look at the sea—which is all the Coast Artillery can do in a modern war. In 1930 Bunch had exposed himself to the sales influence of Bart Stevenson, one of Monocoupe's star salesmen, and had fallen immediately. In 1933 he bought a Monocoupe, sold the Chevrolet agency, let his airport go back to pasture and two cows who had been hanging around expectantly, and went to work as a salesman for the Monocoupe Company. In 1934 he was out of a job again, due to a disagreement with the management, but in January came back as sales manager, under new management. On May 1, 1935, he took over control of the company, when it was at a low ebb: the receiver was barking at the door like the well-known wolf getting at the three little pigs. He huffed and he puffed, like Colonel Johnson trying to explain the Department of Commerce and its mis-handling of aviation, but he never got anywhere, for Bunch got the company going again, sales were steadily moving forward, and when last I saw Clare he was building two ships per week and speeding up production.

Bunch has been completely packed with education. He graduated from Linn Creek school, now sunk as low as a Director of the Bureau of Air Commerce, graduated from high school at the age of 19, studied electrical engineering in Washington University, St. Louis, and was graduated in 1926 with a Bachelor of Science degree in electrical engineering, winning a research fellowship and staying at the University as a graduate student and instructor, and leaving in 1928 with a Master of Science degree. This means that he knows practically everything except how to make out an income tax form. And that is an art in itself, understood only by Al Capone and Elliott Roosevelt.

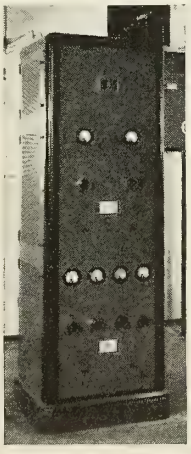
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Floyd Bennett Airport's busiest charter plane! Owned by Erickson & Remmert, it is chartered by newspaper and news-reel men and for private use. It is equipped with RCA TransmitterAVT-7 and Receiver AVR-7C.





RCA equipment at Floyd Bennett Airport! *(Right)* RCA radiobeacon radiotelephone transmitter—*(Above)* remote control in the tower.

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"All clear! Come straight on in from the north side... use north-south runway."

Before arriving at the field, the pilot of the fast Waco pictured here received that message on his RCA receiver. The airport, transmitting with RCA equipment, thus completed the radio guidance enjoyed by the pilot throughout his journey.

Nothing gives you a warmer feeling of confidence and security ...provides greater flying convenience...than having modern radio equipment on your plane. With it, flying becomes a new pleasure!

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**LOOK** FOR BERRY BROTHERS' EXHIBIT, BOOTH 210, NATIONAL AVIATION SHOW, NEW YORK CITY


# CYDELITES on the NEWS

CY CALDWELL

● Well, I see by the papers that several airliners recently stopped some miles short of their scheduled destination. I'm not going to say much on the subject of crashes at this time, as I've pretty well covered the basic situation in many previous articles. I also see where some folks blame the Department of Commerce, some blame the airlines, some blame the pilots, and some, including myself split up the blame all around, a little here, a little there, including a slice to what we may call bad luck, for want of a better name. But having done that, in the interest of fairness as I see it, I still come back to where I have been placing the chief blame for the past two years —on the doorstep of the Department of Commerce.

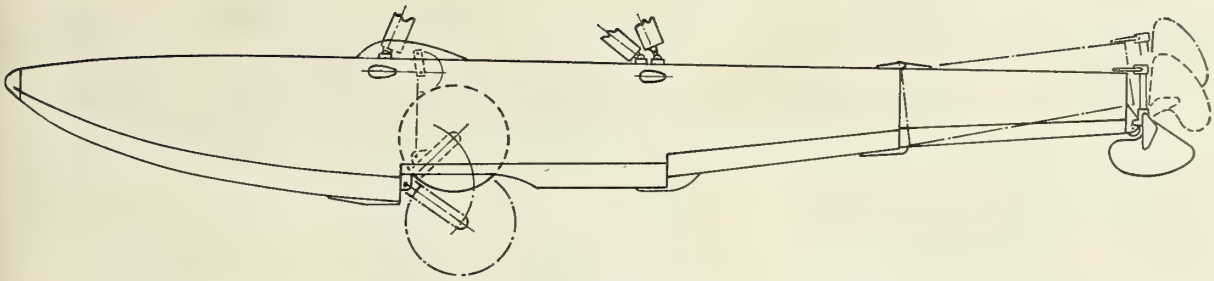
If a business encounters disaster we don't start by blaming the office boy and then working up through the operating and executive departments to the president of the company; instead, we start at the top and work down. And the top, the very pinnacle of power of this whole airline situation is the Assistant Secretary of Commerce, Col. J. Monroe Johnson, whose experience of aviation dates back only a year and a half! All that Col. Johnson knows about aviation he has picked up in that period, when he could spare time from his other duties of running the maritime shipping of the nation and also the fisheries.

The Colonel, ignoring the recommendations of the Copeland Committee for a thorough housecleaning in the dusty Bureau of Air Confusion, and the removal of Vidal and Martin, now announces "plans" of the Department to modernize its radio navigational equipment. I heard that plan, or one like it, discussed over a year ago. As for the Copeland report, it was interred last year beside the late General Grant in his marble walk-up apartment on Riverside Drive.

David L. Behncke, President of the Air Line Pilots Association, advocates turning the control of commercial air transport over to the Interstate Commerce Commission, a body as non-political as anything in Washington can possibly be. This recommendation was endorsed by representatives the Air Line Pilots Association, when they appeared before the President's Federal Aviation Commission, whose recommendations the President has ignored. It would be a simple matter to turn all of the responsibilities of the present Bureau of Air Commerce, together with all their records and all their good employees over to the I.C.C. Most of the personnel are fine, honorable, hard-working, conscientious men, as thoroughly disgusted with the present heads of the Bureau as the rest of aviation is. Why is this step not taken? The answer obviously is politics.

It is utterly useless and besides the point to blame airline pilots, or even the airlines themselves, or the weather reporting service, for these recent crashes. All must share the blame, to some extent, it is true. But the major responsibility lies at the top, as it lies at the top in any business, in any Army, in any Navy, in any Air Force. And the Director of the Bureau and his overlord, Col. Johnson, are the responsible executives; theirs is the responsibility, theirs is therefore the blame. Do airlines "push" pilots into impossible weather? Do pilots compete with each other to complete schedules? Are some pilots insufficiently trained in instrument flying and in dead reckoning navigation? I suspect that the answer to all of these questions would be yes. Even so, the responsibility for any and all of these conditions lies at the top. With a competent Director of Air Commerce, could such conditions be? They could not be, and everyone in aviation knows it. Pilots can be disciplined, so can airlines; the Director has the power to discipline both. But he must be a MAN to do it.

You can argue it around and around until the last airliner has hit the last tree; you may analyze this crash and that, pin blame on this pilot, that airline, this function of the Department of Commerce that didn't function properly —but in the end you'll find that you have only been reasoning in a circle, for in the end you will come back to that one MAN who holds the chief responsibility. Whether he is in the Department of Commerce, as he is to-day,— in several sections,—or whether he is in the Interstate Commerce Commission in the person of one individual, he must, in the final analysis, be a MAN. So the President of the United States, whose responsibility it is to appoint efficient executives, should have a sign painted now to hang on the White House door: "WANTED: A MAN TO RUN AVIATION."



# Amphibious Gear Developed by Edo Aircraft

● Owners of land planes of the sport or private-operator type may easily convert their planes into amphibions by substituting for the conventional land gear a new-type amphibious float gear developed by the Edo Aircraft Corp.

Although requiring less than a year to design and build, the new gear has been developed as the result of research and test work by Edo which extends over a period of more than five years. During this time, three types of amphibious floats were built and tested on company-owned seaplanes, in addition to the production of a special-type of amphibious float for Seversky.

As fitted on a standard cabin Waco, the new Edo gear minimizes the complications associated with amphibion operations. In doing so it introduces a number of interesting features, particularly in the matter of water rudder control.

The gear has the appearance of a standard Edo float with its balanced water rudder swinging beneath it. When the rudder is retracted, however, the transom is fitted with a large roller which protrudes slightly below it, while the rear bottom is curved sharply downward, heavily armed, and surfaced with Stellite at the center.

The aft 4 ft. of the float is a separate, removable section, hinged at the deck and fitted with a Bendix shock strut, which by means of a linkage arrangement, provides the tail with 7″ of oleo-sprung travel. The result is a combination wheel and skid on the transom which requires no attention and which eliminates the tail wheel interference of the conventional arrangement. At the same time it gives the effective water rudder control which no steerable tail wheel alone can provide.

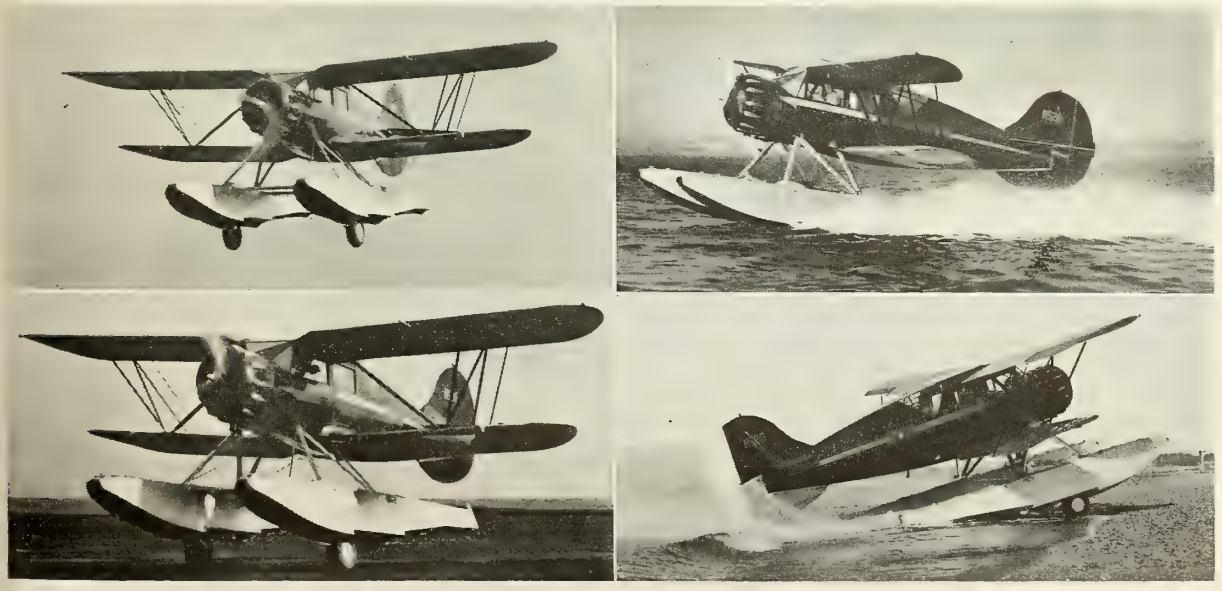
Each of the wheels of the main landing gear is supported by a pivoted yoke, which connects through a Bendix shock strut to a small crank concealed under the float deck. These cranks are operated in unison by a handle (working on a 24:1 reduction ratio) in the pilot's cockpit and rotate through an arc of approximately 190°. Their motion from positive dead center locks in both the "down" and "up" positions and retracts the wheels wholly within the floats through a well in the bottom. The position of the wheel is indicated on a splined transverse tube between the two floats. Adequate brakes, tied into the normal control system of the plane, are provided.

Wheels are located in the conventional position, well forward of the center of gravity, while a secondary step is placed ahead of them so as to shield the bottom opening from water interference. The compartment in which they are carried is air tight at the top so that its buoyancy is retained through the diving bell effect. Heavy keels provided at all wearing points on the float bottoms permit the amphibion to be handled advantageously on ramps like a conventional twin-float seaplane, with wheels retracted, or removed, if desired.

Construction of the gear follows standard Edo practice using corrosion-proof Alcald sheet, in combination with anodically treated duralumin rivets, castings, and extruded sections. The customary longitudinal flutes on the forward bottom are displaced by the use of the secondary steps, but the principles of the monocoque structure are retained, and the amphibious float gear shows all of the maintenance features which Edo has developed.

The new floats will be produced in two models this season, suitable for ships in the 4-5 place class weighing from 3500 to 4000 lbs. as seaplanes. The design has been given component accessory approval No. 73 by the Bureau of Air Commerce which sponsored its design and construction.

*Edo's new amphibious float gear on a Waco cabin plane demonstrates its practicability for operations on the land and water*

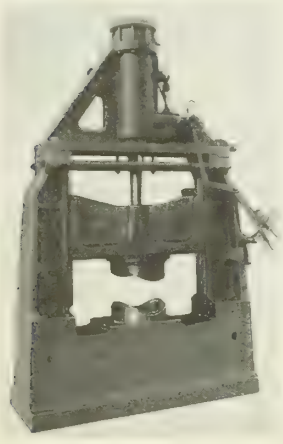


# EQUIPMENT and METHODS

## Pneumatic Hammer

Accelerated production of wing and fuselage sheathing is claimed for the new pneumatic hammer developed by Chambersburg Engineering Co. Operated by 75-100 lbs./sq. in. of compressed air, the hammer can handle practically any forming operation in the manipulation of sheet metal for aircraft production.

Although giving the appearance of conventional design, the cylinder in this hammer is smaller than that usually fitted to a steam or air-operated hammer. The ram is a light-weight ribbed design and its weight may be adjusted or the general design modified to



accommodate any shape to meet special requirements.

The tool may be operated by hand levers, or by a conventional or special type treadle. If a treadle is desired, it is placed so that the operator has maximum visibility of work and complete control over ram movement.

The blow may be delivered and, if desired, pressure maintained for any length of time with the ram or upper die in contact with the work.

## Tire Remover

Dismounting an airplane tire is now a 5-minute job by using a new device developed by United Air Lines' station personnel at Seattle.

A welded steel automobile rim has welded on its top two parallel pieces of 1.5" angle irons. These pieces in turn support two pieces of 1" pipe, mounted on which is a 1-ton *Black Hawk* hydraulic jack. Two pieces of 2.5" pipe, welded and bolted to a hangar girder, provide the resistance for the jack.

To remove a tire from its wheel, the tire is laid on the floor and deflated. The rim then is placed over the inner edge of the tire and the jack is pumped up, thus applying a steady pressure to break the tire loose. This operation is performed on both sides of the tire. After the tire has been loosened by this method, the wheel is clamped in a specially built vise consisting of a 2.5" piece of pipe with a fork to hold the wheel from turning. Mounted on the pipe are two Timken roller bearings to prevent injury to the wheel during the removal process. This vise holds the wheel firmly while the tire and tube are dismounted.

## Semi-Automatic Metal Cutter

A semi-automatic machine for cutting any light section material which can be cut with metal cutting saw blades is now being manufactured by DeWalt Products Corporation.

Material is manually started into the feed jaws, automatically pushed against a length stop, clamped simultaneously on both sides of the saw kerf by an automatic vise, and then cut off. The saw then draws back, the stop lifts, the stock feed mechanism pushes another section of the material into the vise, displacing the stock cut off, and the process is repeated. This machine will cut off light wall tubing 2" in diameter and 6" long, for instance, at the rate of 28 cuts per min.

Power for mechanical action is obtained from a single 1 hp motor, driving through a variable speed type V-belt pulley, and equipped with a slip clutch so that machine action is under convenient control of the operator at all times. By a simple double crank, the saw motor is fed along the arm, with an arrangement for adjusting the forward position in proper relation to the material being cut. The material itself is fed into the automatic vise by a crank operating through a cross head to give a straight line movement. Length of material fed is controlled by the throw of the crank. For cutting off extremely long pieces, operation of the machine may be slowed down—for this reason a variable speed drive is used in the feed mechanism.

Stock feed jaws are driven through a compression spring arrangement, designed not only to insure position against the stop at the time the stock is gripped in the vise, but also to eliminate damage to the machine if the incoming material fails to feed. These semi-floating jaws grip the stock by an angular pinch, so arranged that the center line of the stock is always on a fixed line of the machine.

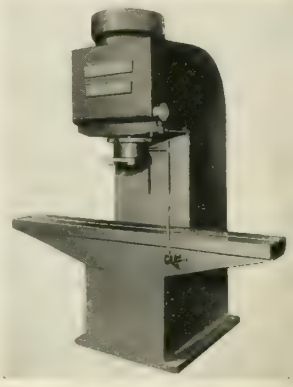
*United Air Lines' tire remover which cuts maintenance time by doing its work in about 5 minutes*



The vise is made of four clutch jaws, two on each side of the saw kerf, so that the material is firmly held until pushed out of the way by incoming material. Operation is automatic and the grip is secured by a toggle mechanism. The jaws are self-equalizing and the material, therefore, always held on the same machine line. Controlling the grip of the vise jaws is a compression spring which eliminates the tendency to crush light wall material.

## Propeller Straightener

A 75-ton capacity, hydraulic press, especially designed for straightening operations on air-



plane propellers and similar work requiring accurate straightening, has been developed by Hannifin Manufacturing Co.

Simplified handling of straightening operations and increased production result from the design of the control mechanism. A single lever controls all operations of the ram, with sensitive proportional control action. When the control lever is moved in either direction, the ram moves a proportional distance and then stops.

Simultaneously, the operating valve shifts to neutral and the pump idles at zero pressure. Thus the operator, by moving one operating lever, obtains a ram movement at full pressure through the exact distance required for straightening any piece. Slight and accurate ram movements, either up or down, may be obtained. The arc of movement of the control lever is several times the ram stroke, providing sensitive handling.

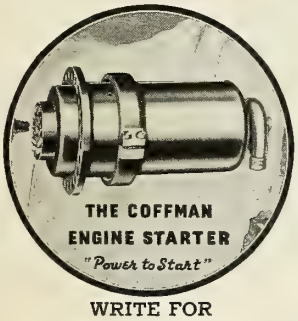
The ram may be fitted with any type of fixture required for handling the parts to be straightened. Ram stroke is 12"; speeds are: power stroke 24"/min.; return stroke 40"/min.

*(Continued on following page)*

# Two Popular Aces . .




## GRUMMAN SHIPS and COFFMAN STARTERS




The Coffman Starter has been selected as standard equipment on the new twin-motored amphibians and single motored fighters, by Grumman engineers.

Light weight and rugged construction are two necessary qualifications that are embodied in the Coffman Starter. A low maintenance cost mades it economical to operate.

WRITE FOR BOOKLET NO. 49

FEDERAL LABORATORIES, INC.
185 FORTY-FIRST STREET PITTSBURGH, PENNA.

*Coffman Engine Starters and Cartridges are fully Protected by Patents in United States and Foreign Countries*

## THE GRUMMAN "G-21" AMPHIBIAN

All Metal — High Speed — Twin Engine



*Scale Model*

AVAILABLE FOR SUMMER DELIVERY

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Room 211, Professional Bldg., Hicksville, L. I., N. Y.
Telephone: Hicksville 1013

Exclusive Sales Representatives for
**GRUMMAN AIRCRAFT ENGINEERING CORP.**
Farmingdale, Long Island, New York



(*Continued from preceding page*)

## Engine Heater

Anticipating operational difficulties due to extreme winter conditions, B. E. Braun, operations manager of Chicago & Southern Air Lines has designed an inexpensive engine heater that is quick, safe and economical. Tests at temperatures of 15° have indicated that the heater can warm an engine in less than 20 min. so that it is practically ready for flight. The oil inlet temperature of the engine was up to 100°, the oil tank had been brought to 74°, and the head temperature 200°.

The heater is made from a 30-gal. oil drum by installing a small grate about 12" from the bottom; by placing a pipe underneath the grate a 6-volt electric auto fan is then installed. This can be quickly connected to a battery and supplies a forced draft. The upper pipe extending from the stove has 3 wire screens to prevent sparks or flames reaching the engine.

The heater is attached to the engine directly on the nose cowling behind the propeller and is held in place by a flange which extends on into the nose cowling. It is made in two sections and held together with hood clamps. A deflector is placed in the lower section so as to force the heat down to the bottom cylinders, allowing it to rise around the entire engine. A heavy insulated canvas covered blanket is thrown around the cowling for additional insulation.

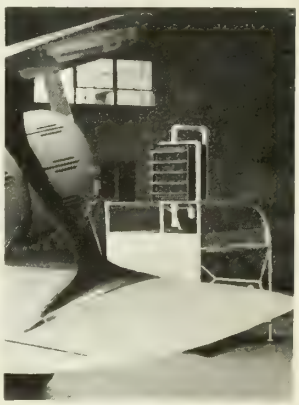
* * *

Another engine heating device made from various parts is being used at the Indianapolis Municipal Airport.

Designed by I. J. Dienhart, airport superintendent, this unit uses steam as the heating agent. It is connected with the airport steam heating system by a rubber hose. The steam is then circulated through a radiator system and is then blown against the engine of the plane by a fan arrangement.

* * *

Roberts Manufacturing Co., has developed a 10 lb.-heater, small in size, measuring 8" × 12" × 13". This compact and inexpensive heater does a thorough job in from 20 to 30. min with temperatures at -30°.



*Dienhart engine heater*



## Corona-less Spark Plugs

New type shielded and unshielded spark plugs have recently been developed for aircraft use by the Champion Spark Plug Co.

Featuring a permanently tight gas-tight seal, this mica plug also incorporates engineering features which eliminate corona. According to Champion's chief engineer, O. C. Rohde, recent experiment and research has shown that corona has a definite bearing on performance, inasmuch as it causes hard starting and rough engine operation and that it actually is a current leakage.


RADIAL AIR-COOLED ENGINES

260 HORSEPOWER

LYCOMING

CONTROLLABLE PROPELLERS

Write for descriptive booklet

*Lycoming Division*

AVIATION MANUFACTURING CORPORATION

WILLIAMSPORT, PA.

# DIGEST OF THE NEWS

## SCHOOLS

### Boeing Scholarships

Scholarship awards at the Boeing School of Aeronautics, Oakland, totaling more than $11,000 in tuition value, will be made during 1937 in the form of the eighth annual W. E. Boeing Scholarships, according to T. Lee, Jr., general manager of the school.

First award is the Airline Pilot and Air Transport Engineering Course, involving 250 hours of flight instruction and 3700 hours of lecture, laboratory and shop work. Second, third and fourth awards offer selection of six different ground school courses. The competition is open to under-graduate students of accredited colleges, universities and junior colleges in the United States and Canada.

### New School

The Oklahoma School of Aeronautics started classes January 12 with Lieut. John E. Cook, acting as chief instructor. Classes are held twice a week during the evening and cover a period of 13 weeks. The new organization has offices in the Braniff Building, Oklahoma City.

### Enrollments

Each of the 31 new students who registered at Parks Air College beginning with the mid-winter term January 4 enrolled for two year courses. A total of 248 students are now enrolled as follows: engineering 88; aviation operations and executives 15; professional flight 30; master mechanics 105, and special 10.

### New Courses

Several new courses have been added to the curriculum of Lincoln Airplane & Flying School including the Air Chief Course and the Airline Mechanic's Flight Course, either of which enables students to earn both a Pilot's and a Government Mechanic's License.

Of interest to those holding transport licenses, is the new non-scheduled instrument rating course which covers 20 hours of instrument flying and radio operation to qualify for the new Department of Commerce requirement.

According to E. J. Sias, president of the school three Kinner-powered PT planes have been added to the fleet of training planes bringing the total to about fifteen.

## AIRPORTS

### WPA Report

Expenditure authorizations made by state WPA administrators for airport work reached $56,027,283, and the program so far authorized is now estimated to be more than 50% complete. The program now includes 616 projects at 446 airport sites.

Airport construction work in Texas is costing $308,155. The program includes 9 airports and

(*Continued on following page*)

*Seven foreign countries are represented by this group of Lincoln Flying School students*







**. . . Announcing a 13½% Reduction on Single-Motor Installations**

**Good business for us means good news for you! We are passing along the benefits of the rapidly growing sales of LUX Lightweight Airplane Fire Systems.**

***We announce a 13½% reduction in the price of LUX Systems for single-motored planes.***

**You are familiar with the fact that LUX protects 90% of all airliners—that it reduces insurance costs. A dashboard control floods the engine compartment with a cloud of LUX carbon-dioxide snow-and-gas. Fast-expanding, this fire-killing blizzard reaches every smallest crevice, *even into the heart of the carburetor.* It takes about 3 seconds to snuff out the severest engine fire.**

**Your LUX system is just as effective at top flying speeds as when the ship is on the ground. Though LUX snow is sure death to fire, it is clean, dry and harmless to engine, wiring, or pilot.**

**LUX Announces Weight Reduction, Too**

**An engineering improvement in LUX valve design has brought about a saving of over 10% in weight on certain installations. Minimum overall weight is now under 15 lbs.**

**With Lux the fear of fire is removed. Get this sure protection for your ship.**

***Fresh from the press is our handsome new brochure, "White Magic." It completely describes LUX protection for airplanes. Write for your free copy.***

**Walter Kidde & Company**

213 WEST STREET, BLOOMFIELD, N. J.

**LUX AIRPLANE FIRE SYSTEM**

*IT COSTS LESS TO OPERATE A BEECHCRAFT*




RECOGNIZING the mandate of modern business that operating costs shall always represent a minimum, BEECHCRAFT has emphasized economy as an attribute of every plane designed in this plant.

With the same power — the same hourly fuel consumption—the same engine maintenance, BEECHCRAFT gives you from 20 to 30 miles *more distance per hour.*

Too, BEECHCRAFT'S extra legal load allowance, resulting from improved design, and its extremely rugged construction which reduces maintenance to a minimum, combine to give you *more miles per dollar.* The per-mile operating cost is comparable to that of an automobile.

You save dollars and hours when you fly a BEECHCRAFT.

*BEECHCRAFT*

*BEECH AIRCRAFT CORPORATION*

General Offices and Factory: 6403 East Central, Wichita, Kansas, U.S.A.

*(Continued from preceding page)*

one air-marking project. Authorized WPA expenditures, plus local funds are as follows: Beaumont, $47,906; Brownwood, $19,799; Ft. Worth (Meacham Field) $28,490; Galveston, $17,141; Laredo, $7,173; San Antonio, $93,389; Temple, $20,421; Tyler, $4,048; and Wichita Falls, $67,837.

Ohio airports are getting $4,845,978, with the work apportioned as follows: Centerville, $138; Henry Township, $691; W. Richfield, $176; Dayton (Wright Field), $150,696; Zanesville, $350; Akron, $471,885; Cincinnati, $30,314; Cleveland, $3,341,499; Columbus and Vandalia, $632,563.

Fifty-seven projects in Michigan were completed or are being carried forward, and 25 others have been approved but not yet started. In addition 476 markers have been completed.

### Field Dedicated

Ten thousand persons gathered at Morrison Field, the West Palm Beach (Fla.), municipal airport for its dedication. Participants included Lt. Joseph C. Mackey, acrobatic flier, Earl Stein, parachute jumper, Richard (Dick) Merrill, Maj. D. H. Young, Maj. Hugh Watson, Wright Vermilya, Richard Lemon, Capt. Alex Papana, Rumanian stunt flier and Bill Sweet.

### Expansion

With the addition of new lathes and drill presses, metal bending and riveting devices as well as spraying equipment, the shops of O. J. Whitney, Inc., Hangar No. 2, North Beach Airport, are now accommodating every type of service job including complete rebuilding of airplanes. Factory station equipment for Menasco and Jacobs engines has also been installed.

### 2342 Airports

On January 1, 1937 there were 2342 airports and landing fields in the United States according to the Bureau of Air Commerce. Of these 705 were partially or fully lighted for night use.

The total included 738 municipal and 451 commercial airports, 296 Department of Commerce intermediate landing fields, 622 auxiliary fields, 26 Naval air stations, 61 Army airdromes and 148 miscellaneous government private and state airports and landing fields.

On January 1, 1936, there were 2369 airports and landing fields.

Six states had 100 or more airports and landing fields each on January 1, 1937: California, 181; Texas, 134; Michigan, 123; Florida, 116; Pennsylvania, 111; and Ohio, 106.

### Improvements

Battle Creek, Mich., Camp Custer. New runways, $31,800; permanent buildings, $50,000.

Outagamie, Wis. County Airport. New Hangar $24,000.

Wausau, Wis. Municipal Airport. New N-S runway; widening old runways; extension of E-W runway; seaplane ramp and dock; $70,000. WPA project.

### Personnel Notes

Gerald Culberson has taken over the lease of and will operate the Raven Rock Airport, Portsmouth, Ohio municipal field.

* * *

Pipher Airport, Stroudsburg, Pa., has been reopened by Nelson Flying Service which is offering 24-hour charter and repair service. Donald C. Nelson is in charge.

* * *

Sidles Airways Corp., Sidles, Neb., has given mechanic positions in its approved repair station to Loren E. Fenton and Melvin Jacobson.

## PRIVATE FLYING

### New Club

Organization of the American Flying Club has been completed by a charter group of 10. Officers are Charles Wlock, president; Charles Wellstead, chief pilot and instructor; Helene Stephan and Loyta Loverdon, secretaries. The club has purchased a Taylor *Cub* and plans to headquarter at North Beach Airport, New York.

### New Officers

At the annual meeting of the New York State Aviation Association held in Albany, Max J. Pollett was elected president for 1937. Other officers are W. D. (Jim) Guthrie, vice-president; and Joseph Fitzgerald, secretary-treasurer. The association is making another membership drive and is actively working on the promotion of favorable and opposing unfavorable aviation legislation.

* * *

Merrill C. Meigs, Chicago, has been appointed to the Illinois Aeronautical Commission to replace Eugene McDonald, recently resigned.

* * *

William Clement was elected president of the Battle Creek, Mich., Flying Club at the organization meeting held at the W. K. Kellogg airport. The club is open to both licensed pilots and others interested in aviation. There are 28 charter members, including Fred Bechman and Clair Cross, vice-presidents, and O. T. Prickett, secretary-treasurer.

Five licensed pilots are among the members and they will serve

as instructors. A ground school conducted by Keith Moon, airport manager, is being held one night a week.

The club has been organized to provide flight instruction on a co-operative plan. It is expected that an Aeronca will be purchased in the near future.

* * *

Burdette S. Wright of the Curtiss-Wright Corp., was advanced Jan. 4 from the vice-presidency of Aero Club of Buffalo to the presidency, at a meeting of the club's directors. He succeeds E. Howard H. Roth. Dr. Roy L. Scott was advanced from the office of secretary to the vice-presidency and J. A. Williams was named secretary.

Charles L. Messinger, division sales manager, American Airlines, Inc., was elected treasurer. Leslie F. Marsden, president, Buffalo Aeronautical Corp., was chosen assistant secretary. Lester Benson, factory manager, Bell Aircraft Corp., was elected to the board of directors, to fill the term of Ansley W. Sawyer, whose resignation was announced at the meeting. Other directors chosen were Henry Holland, Peter N. Jansen, Lawrence Tremaine, Michael F. Steffan, Charles M. Van Der Veer and Ansley W. Sawyer.

### Sectional Charts

Publication of the 87th unit in the Sectional Aeronautical Charts of the Department of Commerce, now provides charts especially designed for pilots' use for any part of the United States.

Each chart is approximately 40″ × 20″ representing an area about 300 miles from east to west and 150 miles from north to south, except that a few of the charts along the borders of the country are somewhat smaller.

Designed especially for use in cross-country air navigation, the Sectional Aeronautical Charts have as their bases accurate representation of the political boundaries, rivers and lakes, cities and towns, railroads, Federal and State highways and elevations of the ground above sea level.

## AIRLINES

### 96,019 Passengers

Scheduled airlines operating in continental United States carried 96,019 passengers in November, 1936, according to reports received by the Bureau of Air Commerce, Department of Commerce, from the 21 companies operating during that month.

The 21 scheduled airlines flew 5,639,008 miles, carried 751,890 lbs. of express, and flew 42,890,899 passenger miles during November.

Official Department of Commerce reports reveal that 938,174 passengers were carried on domestic lines during the first eleven months of 1936.

### Extra Fare Planes

The new Douglas *Skylounge Mainliner* of United Air Lines made its aerial debut in January by inaugurating 3 hour 55 minute non-stop service between Chicago and New York. This service is to be followed by three-stop coast-to-coast flights this month.

United's non-stop *Skylounge* flights between Chicago and New York are extra fare schedules, the addition of $2.05 raising the one-way rate from $47.95 to $50.00. United officials determined on the increased fare because the extra luxury of these *Skylounges*, added to the non-stop feature, and the cut in payload from 21 to 14 passengers. There will be no extra fare on the 21-passenger type Douglas DC-3s, nor on the 247-Ds which will continue flying on the Chicago-New York route on one and two-stop schedules.

Outstanding features of the *Skylounge* cabin include deep-cushioned swivel chairs, steam-heat, air-conditioning, sound-proofing that lowers the decibel count to a point lower than Pullman cars, china and linen for hot meal service, bridge tables, binoculars for observing scenery, individual hassocks, personal toilet kits for men and women, special game equipment and intra-plane telephone.

The *Skylounge Mainliners* are powered by two-row 14-cylinder Wasp engines developing 1150 hp each. With its fully loaded weight of 12 tons, the *Mainliner* can climb on one engine to 9500 ft. and attain a twin-engine ceiling of 23,000 ft.

### Schedule Revisions

Flint, Mich., has been added as one of the principal stations on the Milwaukee-Detroit-Washington route of Pennsylvania-Central Airlines. According to present plans, one round-trip daily to Flint from Detroit will be flown with other schedules added as traffic warrants.

* * *

Daily one-stop round-trip flights between Miami and New York on a 7 hr. 40 min. schedule is now offered by Eastern Air Lines. Acquisition of two Douglas DC-3 club car transports has made possible this express service.

The one stop on the 1196-mile route is at Charleston, S. C., where a 20-minute refueling stop is made. This round-trip brings to three the number of trips daily between New York and Florida flown by Eastern Air Lines.

* * *

American Airlines, Inc., is now

(*Continued on following page*)


FLIGHTEX IS TRUMPS!




The ACE of Airplane Fabrics

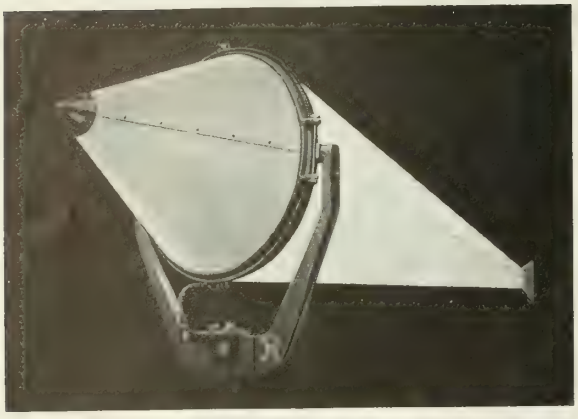
SUNCOOK MILLS

FLIGHTEX FABRIC
REGISTERED U.S. PAT. OFF.

40 Worth Street, New York, N. Y.

Contractors to the United States Army and Navy Air Services

★NEW RADI-CONE



WIND INDICATOR

*Shows direction and velocity day or night*

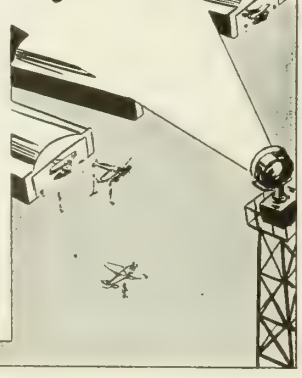
A plain indication of wind direction and velocity is provided by the new Pyle-National Radi-Cone Wind Indicator. The body is of translucent material with red nose and yellow tail, arranged for interior illumination at night. The color combination provides maximum visibility and a wind indication which is quickly judged by pilots day or night. Very sensitive wind action is obtained by mounting the yoke in a free-rolling, long life bearing. Two circuits are provided for double electrical connections as a protective feature. Radi-Cones are available in two sizes (10 ft., and 16 ft. cones) and are furnished complete with steel towers. Write for descriptive bulletin 201.

**The Pyle-National Company**

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WILLIAMS' DROP-FORGINGS for Aircraft

Reliable Uniform Safe



**The unvarying dependability of Williams' Aircraft forgings results from efficient laboratory analyses of material and direct supervision of the various manufacturing processes by a competent metallurgical staff.**

**A well-equipped Chemical and Physical Laboratory and complete forging and heat-treating facilities, combined with a half-century of experience, enable us to positively guarantee every Williams' forging to meet specifications.**

*Any shape, any material and any size up to 350 lbs.*

*Aircraft Division*

J. H. WILLIAMS & CO.

*"The Drop-Forging People"*

New York BUFFALO Chicago

(*Continued from preceding page*)

operating air mail, passenger and express service into Baltimore with twin-motored Douglas airliners over CAM 23, the Southern Transcontinental route.

### New Equipment

Pennsylvania-Central Airlines has purchased a fleet of ten Boeing 247D transports for service between Washington, Pittsburgh, Akron, Cleveland, Detroit, Grand Rapids and Milwaukee. The new fleet is almost 30 miles an hour faster than the planes now being operated by the company making possible reduction of former scheduled flying time.

* * *

Twin-engined Douglas airliners replaced the last of American Airlines' multi-motored Condors operating between Chicago and St. Louis. This makes all-Douglas plane service available on all of the company's six non-stop flights daily between these cities and reduces travel time between Chicago and St. Louis from 121 to 100 minutes.

### Personnel Changes

Orval Mosier, who resigned as city manager of Oklahoma City, Okla., to become vice-president of Braniff Airways, Inc., will be in charge of the company's newly established executive offices at Dallas. Leon Durst, former chief of the Oklahoma City bureau of the Associated Press, has been named Mosier's assistant.

* * *

Appointment of Tommy Chastain as co-pilot for American Airlines operating out of Chicago was announced at Oklahoma City.

* * *

George Mason, formerly publicity man at the Boston Municipal Airport, has joined the publicity and advertising department of United Air Lines at Chicago.

* * *

Leslie P. Arnold, one of the group of army fliers who made the first round-the-world flight in 1924, has been appointed assistant to C. Bedell Monro, president of Pennsylvania-Central Airlines.

* * *

Milton Van Slyck has been appointed as assistant to Jack Frye, president of Transcontinental & Western Air, Inc., and will headquarter in Washington, D. C. Another TWA appointment saw E. A. Hecker designated express traffic manager of General Air Express, a division of the company.

* * *

New American Airlines' vice-presidents are William Littlewood in charge of engineering and Charles A. Rheinstrom, also named general manager.

* * *

C. P. Shropshire has been appointed district traffic manager at Chicago for Eastern Air Lines and H. A. Parks and Harold Nagel have been appointed traffic representatives.

* * *

New chief operator of American Airlines' system is D. W. Rentzel who will be in charge of radio traffic and the instruction of radio operators in radio telegraph and telephone operation.

* * *

Franklin Armstrong, formerly sales representative of Hanford Airlines, is now with the Minneapolis sales office of Northwest Airlines.

### PCA to Pittsburgh

Allegheny County Commissioners consummated an arrangement with Pennsylvania-Central Airlines Corp., whereby the airline will move its headquarters, shops and mechanical staff to the Allegheny County Airport in Pittsburgh. In its new quarters, Pennsylvania-Central will conduct a complete maintenance and overhaul division.

In addition to taking over the 100 × 120 ft. hangar the airline also takes all available office space in the Administration Building, including the additions to the building which are now in progress and which are expected to be completed shortly. Pensylvania-Central officials will also continue to occupy the auxiliary building located at the entrance to the Airport.

### Traffic

During the twelve months ending December 31, American Airlines, Inc., transported 255,324 passengers of more than 25% of the number of passengers carried on all domestic airlines over its nation-wide system.

During the year American placed in service a fleet of 20 Douglas Flagships, largest, fast-

*Passengers boarding one of the DC-3 Flagships operated by American Airlines*



est and most luxurious land transports in the country. The fleet will be enlarged. Ten new Flagships already are on order for use to augment present service on principle routes.

* * *

In spite of substantial fare reductions, an increase in passenger revenue of 148% in 1936 as compared with 1935 is reported by Chicago and Southern Air Lines. During the same period air mail and air express showed a correspondingly heavy gain.

* * *

United Air Lines in 1936 carried 230,000 revenue passengers, 2,340,000 lbs. of air express and 6,000,000 lbs. of air mail, and flew a total of 120,000,000 passenger miles (including estimated figures for December, 1936). United's year marks a 29.6 percent increase in revenue passengers, 25.4 percent increase in passenger miles, 35.8 percent increase in air express and 17.7 percent gain in air mail over 1935.

* * *

Record increases in every department of its operations were hung up by Eastern Air Lines for November, it was reported by Capt. E. V. Rickenbacker, general manager. Air express pounds carried led with a gain of 178 percent over November, 1935. Revenue passenger traffic during the month jumped 76 percent over November, 1935, and revenue passenger miles flown was next with a gain of 61 percent. Mail poundage likewise recorded an advance of 25 percent.

* * *

More air travelers, air mail and air express were carried and more miles were flown over the Milwaukee-Detroit-Washington airline route during 1936 than in any previous year, it was reported by C. Bedell Monro, president of Pennsylvania - Central Airlines. Revenue passengers for 1936 totalled 76,376, air mail 540,481 lbs., and air express 364,538 lbs. These results represent increases of 55% in passenger trade, 42% in air mail volume and 77% in air express traffic over 1935.

The figures for 1936 compare with 49,121 passengers, 381,775 pounds of air mail and 205,741 pounds of air express handled by predecessor companies of Pennsylvania-Central Airlines over the same route in 1935.

### Insurance

Assurance of income during sickness or injury, together with medical and hospitalization costs when necessary, is available to employees of Transcontinental & Western Air, through a mutual benefit plan between them and their employer.

Each employee contributes 1.25% of his or her salary to make the plan operative. The total amount thus derived is matched by the company, which also guarantees additional funds necessary for its operation. Administration of the plan is supervised by an advisory board consisting of one employee each from the maintenance, accounting, operations and traffic departments.

These benefits are in addition to those derived from Social Security and also apply in cases which do not come under Workmen's Compensation.

### Zeppelin Election

At a meeting of the Board of Directors of International Zeppelin Transport Corp., organized in 1929 to study and develop lighter-than-air ships in the United States, it was decided to change the name of the corporation to American Zeppelin Transport, Inc. Edward P. Farley, a director of the company since its inception, was elected president, and F. W. von Meister was elected vice-president.

The company will represent the German Zeppelin Transport Co., operators of the *Hindenburg*, which is to continue its demonstration service during 1937 with between 15 and 20 round trips planned.

## AIR SERVICES

### Re-equipment

Chance Vought Aircraft received an order from the U. S. Navy Department for 40 scout-bombers, basically similar to the Vought SBU-1 of which 84 were delivered during the past year for use on aircraft carriers. The type is a two-seat biplane of metal structure, fabric-covered. It is powered with a 700 hp P & W Twin Wasp Junior engine and is equipped with a Hamilton Standard controllable pitch propeller. It is intended for both bombing and long range scouting activities and is designed to deliver high performance in spite of the limitations of size, weight, and landing speed imposed by operation from the decks of the carriers. The plane has a maximum speed of 205 mph at 8900 ft., and a service ceiling of 24,600 feet.

* * *

27th Division Aviation, New York National Guard, with headquarters at Miller Field, New Dorp, Staten Island, is now taking delivery of its new O-46A Douglas observation airplanes, eight of which have been ordered for its use. According to Maj. Larry Brower, Commanding Officer, these planes are high-wing parasol monoplanes, the first

(*Continued on following page*)




*Powered with 70 h.p. and 90 h.p. LeBlond and 90 h.p. Warner motors*

**There MUST Be A Reason . . .**

$54,000 worth of REARWIN'S were purchased during the first week in January.

**AND HERE IS THE REASON . . .**

REARWIN builds the finest airplanes selling up to $3500.

The REARWIN Sportster definitely has the fastest take-off, quickest climb, highest ceiling and slowest landing of any airplane anywhere near its price. It has a 500 mile cruising range . . . hydraulic landing gear . . . 50 lb. luggage capacity with 50 lbs. additional allowance for extra equipment . . . 24 gallon fuel capacity in wing tanks . . . unexcelled visibility in all directions . . . comfortable cabin . . . superior finish . . . cruising speed of 100-110 miles per hour. You need pay only one-third down to own a REARWIN. Write or wire for our new folder giving COMPLETE details TODAY!

**IT HAPPENED AT MIAMI, FLORIDA**

REARWIN'S superior speed was further demonstrated at the recent Miami races where a stock REARWIN Sportster, during a 25 mile race, completely lapped the entry of our nearest competitor, crossing the finish line 5 MILES AHEAD!

**REARWIN AIRPLANES**

Ninth Continuous Successful Year

Fairfax Airport

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*"REARWIN popularity is proof of REARWIN superiority"*




*"And that's HEADS above anything I ever put on my fleet of ships!"*

The Glidden Company offers to the aircraft industry a new line of PIGMENTED NITRATE DOPES. HIGHER LUSTRE—CLEANER COLORS—INCREASED FLEXIBILITY—EASIER POLISHING—EXCELLENT WEATHERING QUALITIES—***Write for free color card.*** Before re-covering your ship, investigate GLIDDEN FABRICOTE—***Write for free booklet.***

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*North American Aviation "Dragon," an all-metal bomber which will be entered in the Air Corps Competition in March*

(*Continued from preceding page*) monoplane type the organization has had since it was founded more than fifteen years ago. The power plant is the 725 hp Twin Wasp Junior, P & W radial engine.

Engineering advancements installed in the plane include wing flaps, controllable-pitch propeller, radio compass, blind flying instruments and cockpit heater.

### Patrol Squadrons

Two new patrol squadrons have been assigned for sometime this Spring to the Sand Point naval air base in Seattle. Formation of the new squadron with 24 flying boats has been ordered with the equipment to arrive in mass flight soon from San Diego, according to Rear Admiral E. J. King, commanding the base force aircraft units in San Diego.

### New Bomber

North American Aviation, Inc., is now testing a new long range and large load-carrying bomber called the *Dragon*. Aided with the latest improvements for altitude and sub-stratosphere flying, it is expected the plane will have an exceptionally high speed. New type gun provisions and locations render the plane capable of defending itself from any angle of attack.

This bombardment plane has been designed as a midwing, twin-engined monoplane with newly evolved structural arrangements. The center portion of the stressed skin wing is DuPrene sealed and contains four fuel reservoirs. Outer wings are of the single spar stressed skin type equipped with refined type of wing flap with automatic hydraulic control. Ailerons are balanced aero-dynamically, statically and dynamically.

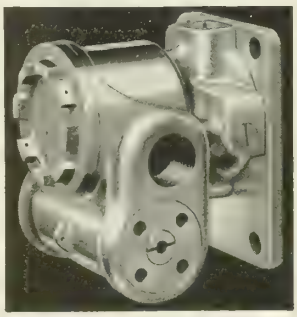
Fuselage is of semi-monocoque construction. Large, to house the largest bomb load provided for on any airplane to date, it further allows the crew spacious and comfortable quarters.

The pilot's control room is exceptionally roomy, providing adjustable passenger-type upholstered seats for a chief pilot, co-pilot, ship's captain and operator. Two bunks are provided to permit some of the crew to sleep during long trips. The portion of the airplane occupied by the crew is soundproofed, heated and ventilated. The cabin is sealed for comfort at high altitudes. Many novel features for improved celestial and terrestrial navigation are incorporated. The fuselage is twelve feet deep and seven feet wide at the maximum cross section. A crew of ten is provided for.

Sperry giropilot and stabilizers, developed by the Sperry Instrument Co., are included, as are Goodrich deicers.

The ship will be powered with engines of from 1000 to 1500 hp and as delivered will carry two 1250 hp P & W engines. Provisions are made for both the


SEVERE TESTS PROVE



EVANS *Aircraft* FUEL PUMPS

**Precision testing at the factory—practical trials under all flying conditions—prove the reliability of Evans Aircraft Fuel Pumps. This finely engineered fuel pump is compact, light in weight and perfect in every detail of material and construction. It incorporates the latest engineering development and is used today in leading makes of transport, private, coast guard and government aircraft. Write or wire for full information.**

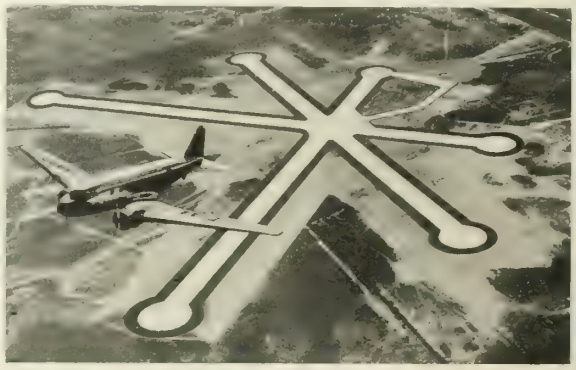
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*Eastern Air Liner leaving the new Morrison Airport, West Palm Beach, Fla.*

Aerial Gateway to Florida's Tropics . . .

West Palm Beach boasts one of the finest Municipal Airports in the country. Recently completed, costing over $250,000, 3000-foot hard-surfaced runways, automatic field lights, located on fully lighted through route . . . approximately 8 hours from New York and Chicago . . . daily EAL schedules. Student flying schools.

Ten minutes from downtown district. Sportsmen and commercial pilots are invited to visit West Palm Beach and use these facilities.

*The Chamber of Commerce will gladly answer detailed inquiries.*

THE CITY OF West Palm Beach FLORIDA

Curtiss and Hamilton Standard types of three bladed constant speed complete feathering type propellers equipped with slinger rings for ice prevention.

The landing gear and tail wheel are retractable by hydraulic power, but also may be operated mechanically through an independent system.

Defensive armament is so arranged that from 3 to 5 high-powered guns can be brought to bear on any point around the airplane, making it impregnable to pursuit attack. Gun mounts are of a new type to permit the operator to work efficiently in high altitudes.

The *Dragon* will be entered in a competition at Dayton, Ohio, in March 1937 when a board of Army specialists will choose the new equipment of the Air Corps for the next two years.

## THE INDUSTRY

### $18,271,077 Exports

Value of aeronautical products exported from the United States through October 1936 was more than 50% ahead of that for the same 1935 period and almost 28% better than the full year 1935. During the first ten months of 1936, there were exported 403 aircraft, valued at $8,786,326; 727 engines, ($4,128,444); $266,794 worth of parachutes and $5,089,513 worth of parts and accessories, bringing the total to $18,271,077 not including exports to our non-contiguous territories which raised the total to $18,551,361. This compares with $12,221,302 for the first ten months of 1935.

Best customer thus far in 1936 is China which imported $6,785,384 worth of American aeronautical products. Argentina purchases accounted for $1,535,755 worth of American products while other sizable purchases were made by buyers in The Netherlands, $857,240; Canada, $581,919; Italy, $580,995; Australia, $628,475; Japan, $613,540; Peru, $449,754; Mexico, $479,334; Siam, $466,007; Brazil, $427,952.

### Bendix Radio Unit

Formation of Bendix Radio Corp. to specialize in aircraft radio equipment for communication and navigation, and particularly for instrument flying and blind landings under adverse weather conditions, was announced by Vincent Bendix.

Absorbing four radio and aviation equipment companies Bendix Radio Corp. will be immense in scope and operations, having plants and laboratories in Chicago, Dayton, Washington and Oakland, and employing more than 100 engineers and technicians.

Companies taken over by Bendix are Radio Research Co., Inc., Washington; Radio Products Co., Dayton; W. P. Hilliard and Jenkins & Adair of Chicago.

Officials include Mr. Bendix, president; L. A. Hyland, vice-president & general manager; R. T. Hurley, W. P. Hilliard, vice-presidents, and C. E. Mead vice-president & works manager.

### New Dealers

Capt. (Dr.) Arthur LaRoe, who distributed Eaglerocks some years ago, has just taken over the distributorship for Rearwin aircraft in the Metropolitan New York area. "Doc" LaRoe's territory includes the northern half of New Jersey, Long Island, and a few counties in lower New York State. According to tentative plans, headquarters will be maintained at North Beach Airport, Jackson Heights, N. Y.

* * *

Appointment of Howard Batt as Ryan distributor for southern California has been announced. Headquarters will be at Clover Field, Santa Monica, and territory includes all counties south of the Tehachapi mountains with the exception of San Diego.

* * *

Gillies Aviation Corp., Professional Bldg., Hicksville, Long Island, N. Y., have been appointed distributors for the Fleetwings

(*Continued on following page*)

## Coming Events

National Aviation Show, auspices Aviators' Post 743, American Legion, Grand Central Palace, New York. Gus Parsons, managing director, Jan. 28-Feb. 6, 1937

•

Second Annual National Pacific Aircraft and Boat Show, Pan-Pacific Auditorium, Los Angeles, Calif. Cliff Henderson, managing director, Mar. 3-21, 1937

First Salon International de Aeronautique. Palais du Centaire, Brussels, Belgium. Sponsored by Ministry of Transport and Belgium Aero Club. June 18-30

•

National Air Races. Municipal Airport, Cleveland, Ohio. Cliff Henderson, managing director. Sept. 3-6





The RYAN
Comes to Roosevelt Field!

Braman-Johnson Flying Service, Incorporated, announces their appointment as dealers for the new Ryan ST Series

**The Ryan is now available for demonstration at Hangar B, Roosevelt Field**

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FLYING SERVICE INC.

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● Write Us Concerning Your Requirements

THE
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1931 Antoinette Detroit, Mich.



*The new Stearman-Hammond factory recently opened near the San Francisco Municipal Airport*



Dealership for Ryan S-T planes was taken over by Braman-Johnson Flying Service, Hangar B, Roosevelt Field, N. Y.

* * *

O. J. Whitney, Inc., North Beach Airport, Jackson Heights, N. Y., has been appointed distributor by Cessna Aircraft Corp. for their model C-37.

### Expansion

Stearman-Hammond Aircraft Corp. opened its new factory on a site half a mile north of the San Francisco municipal airport. With more than 25,000 sq. ft. of floor space, the new factory is modern in design and fully equipped with up-to-date machinery for the manufacture of aircraft. Operations are now under way and it is expected delivery of the first plane

(*Continued from preceding page*)

*Sea Bird* amphibion in the Metropolitan New York, New Jersey and New England area; and for the Grumman twin-engined amphibion G-21 in the United States and foreign countries. Gillies also is distributor for Waco, Stinson, Fairchild and Beechcraft airplanes. Other *Sea Bird* distributors just appointed are Clifford Condit, Pal-Waukee Airport, for the Chicago area and Wisconsin; Smith Flying Service, Wilkes-Barre-Wyoming Valley Airport, for northeastern and central Pennsylvania; Mouton and Clyde, Inc., San Francisco, for Northern California; and Weddell and Smith, Detroit City Airport, for the Detroit area and Michigan.




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**TAYLORCRAFT Aviation Company** **Alliance, Ohio**

*Third Annual*

DIGEST OF AMERICAN AIRCRAFT, ENGINES, ACCESSORIES

***March issue***

1) Follow up the seasonal sales stimulation of the National Aviation Show

2) Prepare for — and sustain interest during — the National Pacific Show

3) Tell your story to your market *the world over* — at no extra cost.

*Write for folder explaining these three points in detail.*

AERO DIGEST, 515 Madison Avenue, New York, N. Y.

will be made in the immediate future.

* * *

Aero Engineering Corp. has moved its manufacturing facilities from Long Beach, Calif. to Metropolitan Airport, Van Nuys. Negotiations are being concluded whereby land and buildings consisting of 19.7 acres improved by a number of structures, principally three hangars providing approximately 50,000 sq. ft. of factory space will be acquired. The corporation plans to remodel the largest building and will have available 25,000 sq. ft. for its initial production unit. Tenants of the present owners occupying the other hangar will continue in their present tenancy.

### Sales Tour

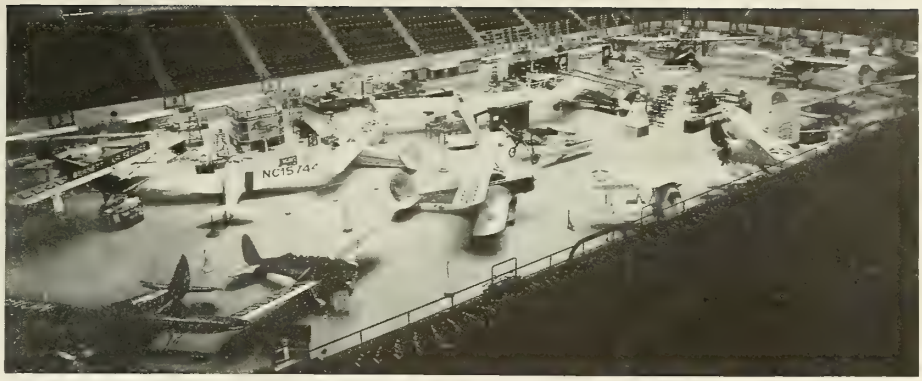
O. J. Whitney of North Beach Airport, Jackson Heights, N. Y., is again making a sales and demonstration tour of Central and South American countries. Repeating his trip of last year, Whitney is flying a model C-17B Beechcraft equipped with a 285 hp Jacobs engine.

At least 23 cities in 14 countries will be visited, including Havana, Puerto Barrios, Guatemala City, San Salvador, Teguciagalpa, Managua, San Jose, Cristobal, Medellion, Bogota, Cali, Quito, Guayaquil, Talara, Lima, Arica, Santiago, Mendoza, Buenos Aires, Montevideo, Porto Alegre, and Rio de Janeiro.

Whitney is representing the manufacturers of the Kruesi radio compass, Pioneer instruments, Merrimac finishes, Lux fire extinguishers and fire extinguishing systems, Wilson products, as well as Beechcraft and Jacobs.

### Air Shows

Air Observance Week was held in Philadelphia, Pa., Jan. 9 to 15,



*View of the exhibits in Convention Hall, Philadelphia*

under the sponsorship of the Mayor's Aviation Committee, with an air show featuring the celebration.

Held in Convention Hall, admittance to the exhibits was free to the public. A score of aircraft and engines, as well as a number of aviation accessories were on display. Among the features was a specially-edited film history of aviation as well as numerous discussions on various aeronautical topics.

The second annual National Pacific Aircraft & Boat show to be held at the Los Angeles Pan-Pacific Auditorium March 13 to 21 promises to surpass last year's event by a wide margin according to early indications based on advance space reservations received by Cliff W. Henderson, Managing Director.

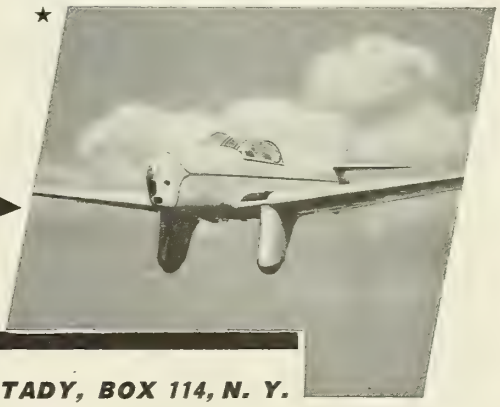
With the event not more than six weeks away, advance reservations for space from aircraft and engine manufacturers, boat builders and the varied accesory groups for both industries are already in excess of last year.


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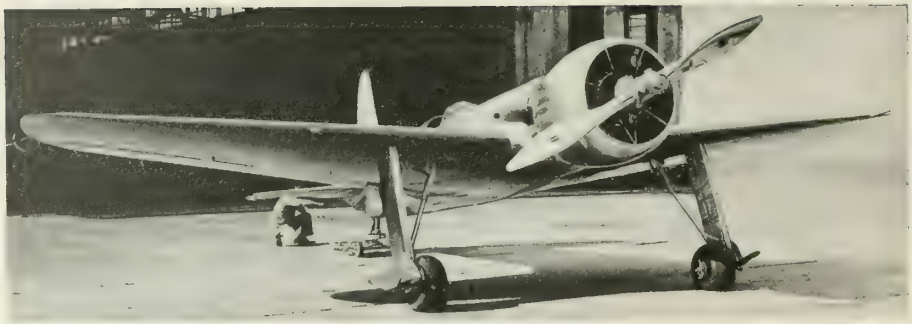
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# Digest of Recent Events



Acme Photo

*P&W powered Hughes Racer which set cross-country mark of 7 hours 28 minutes between Los Angeles and Newark*

**New York-Montreal Time Lowered In Grumman**

Flying a Canadian Grumman two-place Wright Cyclone-powered fighter, Lieut. Howard F. Klein flew from Floyd Bennett Field, Brooklyn, N. Y., to St. Hubert Airdrome, Montreal in 1 hour 40 minutes, setting a new mark for the course which is 17 minutes better than the old record held by Commander Frank Hawks. On the return non-stop flight, Lieut. Klein made the trip in 1 hour 35 minutes, averaging 3 hours 15 minutes for the 715 miles. DEC. 13

**Seversky Sets New Amphibion Record**

Major Alexander P. deSeversky flew 209.04 mph over a 100-kilometer course in Miami to set a new world mark for amphibion planes. The mark bettered the former record of 174 mph held by Boris Sergievsky in a Sikorsky S-43. Seversky flew the Wright Cyclone-powered amphibion of his own design in which he previously set a New York-Miami, and Miami-Havana record. DEC.19

**Maryse Bastie Flies Solo Across Atlantic**

A new South Atlantic flight record was established by Mlle. Maryse Bastie when she flew her 220 hp Caudron Simoun low-wing monoplane from Dakar, Senegal to Natal, Brazil, a distance of 1938 miles in 12 hours 5 minutes. Mlle. Bastie's flight bettered by 70 minutes the former record held by Jean Batten. DEC. 30

**New York- New Orleans Flight Record Set**

Averaging 240 miles an hour, Frank Sinclair, test pilot for Seversky Aircraft Corp., set a new record between New York and New Orleans when he completed the 1200 miles in exactly 5 hours. Sinclair was piloting one of the new Cyclone-powered Seversky planes. JAN. 4

**Hughes Spans Continent In 7 Hours 28 Minutes**

Leaving Union Air Terminal, Burbank, Calif., at 2:14 a.m. (Pacific Time) Howard Hughes flew across the country and landed at Newark Airport at 1:02 p.m. (Eastern Time) after crossing the field at 12:42. Flying the low-wing monoplane in which he established a world landplane speed record, Hughes averaged 332 mph for the 2490-mile non-stop flight. The ship has been slightly altered since its last record breaking venture being equipped with a 1150-hp P & W Twin Wasp Junior. The new time, 7 hrs. 28 min. 25 sec., compares with 9 hrs. 25 min. 10 sec. Hughes made last January. JAN. 19




# AIRLINE ENGINEERING

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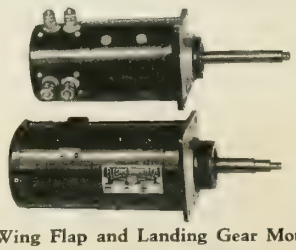
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# FOREIGN NEWS IN BRIEF

## Australasia

The $5,000,000 Commonwealth Aircraft Pty. Ltd., formed to build aircraft in Australia is inspecting factory sites in Sydney and in South Australia.

A club house will be erected for the Royal Flying Club at the new civil airport at Singapore and be leased to the club. $15,000 was set aside for this purpose by the Legislative Council.

Negotiations are in progress to bring the principal air services in Australia under unified control. Australian National Airways, Ltd. is negotiating with British Pacific Trust to purchase its controlling interest in Air Lines of Australia, Ltd., which operates the Sydney-Melbourne-Brisbane service, one of the most important in the Commonwealth.

## Canada

After several years of expanding air mail services into the isolated northland, the Canadian Post Office Department announces that it has found it cheaper to use air mail than dog team mail services. Half the revenue from air mail services into the northland are profit for the government, being above the cost of air transportation. With similar loads of mail going by dog team, it is estimated the post office would be out $100,000 more each year than the total revenue of the air mail service. A new high was established in air mail poundage in 1936, with 1,250,000 lbs. carried, according to preliminary figures. Nine new services were inaugurated during the year into the remote regions. Mining activity has been the principal reason for inauguration of new services and additional flights on existing routes.

Wings, Ltd., with a fleet of eleven planes, flew 770 tons of express and 6670 passengers in the first six months of 1936 as against 1000 tons of express and 7765 passengers in the entire previous year. The company showed a net profit of $51,509 for the six months, as against a loss of $11,309 in the previous year, M. E. Ashton, general manager stated. Stockholders approved a capital increase of 200,000 shares.

## Great Britain

Air Despatch Ltd., which has been operating a week-end service between Croydon and Le Touquet and a daily freight-passenger service between Croydon and Paris, is now providing daily service connecting London, Portsmouth, Bournemouth, Haldon and Plymouth. Schedule permits connection with the company's service to Paris and with North Eastern Airways, on alternate days, to Perth.

Aberdeen Airways (Aberdeen, Scotland) is planning to start operations between Stavanger (Norway) and Aberdeen on April 19 with 3 to 4 trips scheduled weekly. The Norwegian Government has made the reservation that the Norwegian aviation company shall be allowed to operate the route jointly with the concessionaire whenever it may desire to do so.

England's supply of Champion aircraft and automotive spark plugs will be filled by the output of a new $500,000 factory located at Middlesex near London. The factory will be a one-story unit covering 33,000 sq. ft. of floor space and will meet the supply formerly filled from the Champion Canadian plant in Windsor, Ont.

## Italy

Scheduled service is now provided between Rome and Addis Ababa, via Bengasi and Asmara by Ala Littoria Civil Air Transport Co., Savoia-Machetti S73 land planes flying between Bengasi and Asmara and Caproni 33s between Asmara and Addis Ababa.

## Switzerland

The Fourth International Aviation meeting will be held at Zurich-Dubendorf from July 23 to Aug. 1, inclusive. Sponsored by the Aero Club of Switzerland, the affair has been divided into the following events: cross-country flight for sport and private aircraft; climbing and diving competition; altitude; race over a circuit; aerobatics; circuit race over the Alps for military planes; military formation flying; and an autogiro competition.


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## MR. GREY PASSES BY

(*Continued from page 24*)

those words, is so forgetful of them, or so unaware of their cynical import, that he writes that "Cy refrains from jeering at the French and Russians." If that isn't jeering, then I must oil up my jeerer.

Now, my six patient readers, if you think all the above was merely an argument between two literary zanies, which on the face of it, this collaboration may appear to be, I want to assure you that there is more beneath it than meets the eye. My twitting of choleric Mr. Grey and his lashing back at me is no mere personal battle, for personally I like him. But for many years Mr. Grey was wont to speak slightingly of America and Americans, referring often to "the whole civilized world and the United States of America"—one of his pet phrases. As an American, I resented that mildly, though I said little. But in the early summer of 1935 Mr. Grey not only stood on his head, he went into an upside down spin in an article misrepresenting the speeds of our American airlines. Calling on our airline people for the correct information, I published it over two issues of AERO DIGEST and several issues of THE AEROPLANE—for by inviting attack, the unfortunate Grey was practically forced to accept and publish my counter attack.

Now, Mr. Grey, in the opening paragraph of your letter you refer to me as "a recognized humorist with his own line, naturally entitled to a large amount of liberty in dealing with the truth." I submit that in my reply to your letter I have taken no liberties whatever with the truth. Let's get down to business in our next encounter. In the field of humor, I may have a slight advantage over you, though you're a very witty fellow yourself; in the field of learning and education, however, I admit your decided advantage over me—for I left school at the age of 14, and many declare that I have learned nothing since. Now sir, I'll discard all humor, all sly digs, all attempts at wit, all glibness, all personal attack. I'll stick to military aviation—and will you do the same?

By now you have probably read my January article in AERO DIGEST—*The Influence of Air Power Upon History,* in which I forecast the impending doom of England and a wholesale shifting of the population of the British Empire. If I am wrong, prove it to me; if I am right, naturally there is no argument. In a later article I shall forecast the complete destruction of London. Will you say something to that? Can you write anything to refute me. If so, we shall be glad to publish it. Stick to fact and plain statement, as I shall do. The articles may be published in both AERO DIGEST and THE AEROPLANE. As I wrote on another occasion, "I'll see you and raise you two."

## AVIATION SHOW

(*Continued from page 26*)

Navy & Marine Reserve Association; and the Soaring Society of America.

Each day of the show period will be devoted to certain specialized phases of aeronautics. The opening day, Aeronautical Chamber of Commerce Day, will witness the formal opening by Mayor La Guardia. Jan. 29 will be Air Transportation Day; Jan. 30 Junior Birdmen of America Day; Jan. 31 Women in Aviation Day; Feb. 1 Science Day; Feb. 2 Army Day, marked by a luncheon by Air Corps, Reserve, and regular Air Corps officers to Maj. Gen. Oscar Westover, Chief of the Air Corps; Feb. 3 Air Commerce Day; Feb. 4 Navy Day, with Admiral Cook, Chief of the Bureau of Aeronautics, as guest of honor.

Feb. 5 will be American Legion Day with the National Commander and State Commander of the American Legion as guests at luncheon of the National Aeronautics Commission of the American Legion, and in the evening the annual dinner-dance of Aviators' Post #743. Feb. 6 will be Famous Fliers Day.


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## FUSELAGE DRAG

(*Continued from page* 40)

Results show that the relative merits of the radial and in-line engines are about the same. This fact had been proven by performance tests on two airplanes of identical appearance, weights, areas and horsepower. One powered by a 7-cylinder radial engine attained a speed of 135 mph while the airplane powered by a 12-cylinder in-line engine made 137 mph. It can be seen that for the present day cabin airplanes the difference in performance between the radial and in-line engine is of small consequence; the in-line engine, however, has an advantage in increased visibility. Visibility for cabin airplanes intended for the private owner is an important factor, and for this reason the in-line engine is recommended. While some point out that this type of engine has a smaller frontal area than the radial, it must be remembered that this is applicable to small airplanes which themselves have a small frontal area. The modern four- or five-passenger airplane has a cross-sectional area greatly in excess of either type of engine.

Another purpose of these series of tests was to obtain data which would provide a more accurate determination of the performance of full size airplanes. While the models were ⅛ scale in reference to the 4- or 5-passenger cabin airplane, the ordinary methods of converting to full scale may be applied to any size cabin airplane of similar appearance provided proper corrections for scale are made.

The following conclusions are based on a general survey of the results of the tests, which were conducted as part of the authors' undergraduate thesis and in fulfillment of the work required for the degree of Bachelor in Aeronautical Engineering.

1—The design of the windshield is the most important factor in the reduction of fuselage drag.

2—A conical windshield (like No. 3) gives the least amount of drag.

3—A "V" forward slanting windshield (like No. 1) is unsatisfactory.

4—Considering the drag of the two types of fuselages, the convex is superior for the in-line engine while the concave is better for the radial engine.

5—Radial and in-line engines have approximately the same drag on a 4- or 5-place cabin airplane.

6—Drag increases with angle of pitch. It varies as a straight line until an angle of 14° is reached.

7—The type of windshield is more critical for the in-line than the radial engine.

8—The aft section of the fuselage has more effect on radial than in-line engines.

References: 1. Prandtl and Teitjens, *Applied Hydro and Aero Mechanics*. 2. Durand, *Aerodynamic Theory*, Vol. III, Part G. 3. *Aircraft Engineering*, April, 1936.

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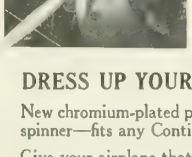
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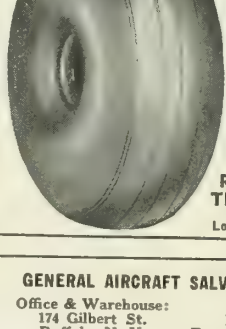
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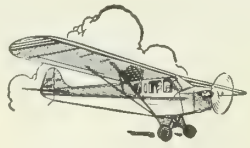
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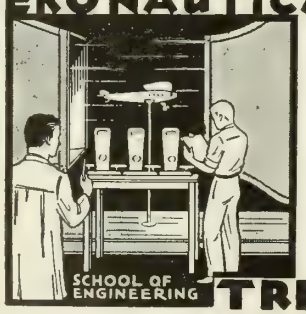
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**SIKORSKY**
**Model S-39**

Dark blue with silver wings. Paint and dope in first class condition. No corrosion. Wasp Junior 300 hp. engine recently had top overhaul. Ship equipped with extra gasoline tanks and is in all around tip-top condition. Total time—600 hours. Reason for sale: owner getting larger ship.

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**WACO Cabin 1933:** 210 Continental; excellent condition; landing lights, flares, motor just majored; $2,500.
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| BELLANCA SKYROCKET, Wasp "C" | $4,750 |
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| FAIRCHILD KR-21, K-5 | 1,175 |
| FLEET, Model 2, KB-5 (Just recovered) | 1,750 |
| FLEET, Model 2, KB-5 (Just recovered) | 1,650 |
| FLEET, Model 2, KB-5 | 1,350 |
| GREAT LAKES, 2T-1A, Cirrus | 950 |
| MONOCOUPE, Lambert 90 | 1,250 |
| ROBIN, Challenger 185 | 1,050 |
| SECURITY AIRSTER, KB-5 | 1,250 |
| SIKORSKY S-39 AMPHIBIAN, Wasp Jr. | 3,750 |
| STEARMAN, C3B, J-5 | 1,350 |
| STINSON "R", Lycoming | 2,650 |
| TRAVEL AIR, S-6000-B, J6-9 "D" | 2,650 |
| WACO CABIN DE LUXE, CJC, J6-7 "E" | 3,850 |

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J-5 RYAN
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Sure, our stock of engines is moving at these prices. About 20 on hand at $250—$500. Moderately used and some equipped with "C" cylinders and radio shield. Total time 300—1100; since major, 57 up. Wasp C cylinders, under .003 wear, $40 ea.; set, $275
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## USED PLANES
*classified by makes*

### *Aeromarine Klemm*

$400 AEROMARINE KLEMM: Air wheels, duals, extra instruments. Licensed to May 15th. Ship perfect, always hangared. LeBlond motor, 85; 491 hours, needs overhaul. Economical; snappy. H. R. Shields, Keeseville, New York.

### *Aeronca*

FOR SALE: C-3 Aeronca; licensed to November, 1937. Ship in excellent condition throughout. $695. H. M. Dunsworth, 306 W. Sixth St., Hutchinson, Kansas.

AERONCA C-3: E-113-A motor, factory majored 100 hours ago. Ship just recovered. Licensed until November 1937. Total time 900 hours. First reasonable offer takes it. AERO DIGEST, Box 2502.

AERONCA C-3: Two-door cabin with compass and heater; new August 1936. 200 hours, never damaged. $1,135. Aeronca low wing: Warner 90 hp motor; navigation lights, air brake, heater; 100 hours, never damaged. $2,675. E. Gomer Jones, Norton Field, Columbus, Ohio.

BEST OFFER TAKES '34 Aeronca. Heater, enclosure, compass. New prop; fuselage recently recovered; new rudder. Never cracked. Paul E. Long, Frankford, Delaware.

AERONCA C-3: Six months old since new. Being completely recovered and majored by factory—land damaged. Also Swallow with new OX-5. Best offers. Tiedt, 8305 Cicero Avenue, Chicago, Illinois.

1936 HIGH WING AERONCA: Only 130 hours total time; never damaged; lights, compass and skis. Priced right. Chicago Aviation Corporation, Glenview, Illinois.

AERONCA C-3: Privately owned; enclosure, compass, air speed, oleo shocks. Excellent condition. $700 cash. Lea Abbott, Hangar No. 1, Love Field, Dallas, Texas.

AERONCA C-3: Privately owned, newly refinished; large airwheels. Licensed to December 1937. $600 cash. Dan Hughes, Hangar No. 7, Love Field, Dallas, Texas.

AERONCA LOW WING: 85 LeBlond; 195 hours total; like new; $1,795. Will finance; no trades. Hinson Motor Co., Cottage City, Maryland.

TWO AERONCA C-3's: Late 1936. Total time 170 and 200 hours. Look like new. Muncie Aviation Corporation, Muncie, Indiana.

AERONCA C-3: Two months old. 10 hours total time. $1,395. $500 down, or will take trade. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

LOW WING AERONCA, wonderful condition, $1,695. Can finance. "Al" Leeward, New Kensington, Pennsylvania.

'34 AERONCA C-3: Guarantee no time since motor major. Brakes, lights, enclosure. Beautiful ship. All yellow. Tripod oleo landing gear. $750. "Al" Leeward, New Kensington, Pennsylvania.

AERONCA C-2 and C-3: Miscellaneous ship and engine parts; C-3 wing panel complete; used crankshaft, etc. J. A. Simcock, Front and Roosevelt Blvd., Philadelphia, Pennsylvania.

### *American Eagle*

OX-5 AMERICAN EAGLE: Licensed, excellent condition; $450. Trade for small plane or car. Velie Monocoupe, just relicensed, excellent condition; bargain, $450. M. Massini, 418 South Main Street, Old Forge, Pennsylvania.

AMERICAN EAGLE: Kinner. Licensed December 1937. Always hangared. New Fahlin prop, duals, military windshield, compass, Elgin clock. Best performing Eagle in Northwest. Perfect student trainer. $590. Consider small cabin trade. Sidney Flying Service, Sidney, Montana.

AMERICAN EAGLE: Three-place, duals. Licensed. OX-5 motor; good condition. Always hangared, never cracked. In hangar at Enid, Oklahoma. Owner now Flying Cadet. $325 cash. Charles H. Young, Cadet Detachment, Randolph Field, Texas.

FRONT EXHAUST Kinner American Eagle: Model 129. NC204N. Just overhauled, relicensed January 1938. Ship and motor perfect shape. $595 cash, immediate sale. Gene Lawrence, Frankfort, Indiana.

### *Amphibions, Inc. (Privateer)*

"PRIVATEER" AMPHIBION: For real sport over land or water. This sturdily built, economical plane with 125 Warner, Heywood, duals, etc., $1,500. AERO DIGEST, Box 2511.

### *Arrow*

ARROW SPORT: LeBlond 65. Engine majored, new cowlings, tires, prop; wings recovered; speed ring; $575. Can be seen Hangar 3, Floyd Bennett Field, or write F. C. Schwarz, 2419 Foster Avenue, Brooklyn, New York.

### *Beech*

BEECHCRAFT B-17-L: Jacobs 225; 30 hours on motor since factory rebuilt. Ship throughout excellent condition. Licensed to January 15, 1938. Complete blind and night flying equipment; Sperry directional gyro, Kollsman sensitive altimeter, R C A radio and special leather upholstery. Color red and cream. Bargain, $5,500. Thomas Davis, Airport, Atlantic City, New Jersey.

BEECHCRAFT B-17-L: Privately owned, never injured. Jacobs 225 hp; total time 270 hours. Just completing major overhaul and installing latest type shielding. Fabric like new. Red, black stripes. Regular instruments, plus flares, landing lights, clock, metal propeller, Western Electric radio receiver, motor cover, tools, stakes and two practically new Russell chutes. Hangared San Francisco Airport, care Pacific Airmotive. Price, overhauled, $6,500. Licensed to April 1937. E. S. McCurdy, Mills Building, San Francisco, Calif.

BEECHCRAFT B-17-L: In excellent condition, with Jacobs 225 hp, major overhauled and modernized at 256 hours, with new cylinders and crankcase. Total time now 322 hours. Fabric just like new; color is red with black striping. Hangared at North Beach Airport, New York City. Extras include Curtiss metal propeller, RCA radio receiver, landing lights, three flares, Pioneer clock, synthetic leather upholstery and side walls, thermocouple and the following brand new instruments: shock-proof instrument panel, turn and bank, self-contained rate of climb, 941 Pioneer compass, directional gyro with ball bank and light, Kollsman sensitive altimeter, rotable air speed indicator, manifold pressure, outside air temperature, carburetor temperature and air time recorder; motor cover, tools and stakes. Price, $5,750. AERO DIGEST, Box 2517.

B-17-L BEECHCRAFT: Landing lights, flares, clock, special upholstery, bank and turn indicator, radio receiver. Finish just like new. New Jacobs L-4 motor with four hours, not taken out of box since returned from Jacobs factory after complete overhaul. Total time, 550 hours. Cost, $10,300. Sacrifice, $5,250. We are extremely anxious to move this ship immediately, if possible. Capital Airlines, Inc., Municipal Airport, Boise, Idaho.

### *Bird*

BIRD: Brand new Kinner K-5. Ship just completely refinished. Military windshield, oleo landing gear, steerable tail wheel, brakes, semi-airwheels. Price, $1,650. W. A. Speer, 3330 Barnett, San Diego, Calif.

K-5 KINNER BIRD: Late type front exhaust. Licensed to October '37. Fuselage recovered, wings refinished when licensed. Motor factory majored fifty hours back. Hamilton prop, full Airwheels, new windshields. Ship guaranteed to be in perfect condition. $950. Gordon Gibson, Red Springs, North Carolina.

BIRD, 125 KINNER: Majored, collector ring, steel propeller, starter, semi-airwheels, new Goodrich tires, duals, brakes both cockpits, entire ship excellent; some extras. H. H. Emrick, Central Airport, Camden, New Jersey.

BIRD: 3-4 place, 125 Kinner; Heywood. 40 hours since majored. Full set instruments, semi-airwheels. $1,500. Red Bank Airport, Red Bank, N. J. Phone: 1730.

### *Bellanca*

USED BELLANCA Pacemaker: Serial No. 305; 400 Wasp Jr. Controllable propeller, Lear radio, landing lights, flares, Sperry horizon and gyro. Plane and engine majored by manufacturer January 1936. Delaware-New Jersey Ferry Co., 4th St. Wharf, Wilmington, Delaware.

DAMAGED Bellanca Pacemaker: Powered with Wright E-type 330 motor. Equipped for night flying. Completely bonded, shielded for radio. Ship now in storage in Utah. Will sell, less motor. Trades accepted. Edw. A. Forner, Jackson, Michigan.

### *Cabinaire*

CABINAIRE: 4-place cabin biplane; powered Wright J6-5; direct electric starter, new aircraft battery, fabric excellent, motor just majored. Very quick take-off. Milton Hersberger, Put in Bay, Ohio.

### *Cessna*

CESSNA: 125 hp Warner. Licensed, recovered; majored 56 hours back. NACA cowling; new wheels, brakes, tires, tubes, semi-balloons. New 360° tail wheel. New upholstery. Standard Steel adjustable prop. Price asked could not buy a greater bargain. Will take late small car and cash difference. $1,075. Joe W. Hendrix, Hereford, Texas.

### *Cub*

NEW TAYLOR CUBS: We accept trade-ins. Many other good buys. Terms, trades on everything. Gordon Box, Taft, California.

1935 MODEL A-40-2 Continental, excellent condition, engine majored, sacrifice. Paul Peterson, 2503 Union Avenue, Altoona, Pennsylvania.

CUB: 1934 A-42 engine; fabric excellent; yellow, black trimming; enclosure. Licensed until August. $700; will take any kind of crack-up as part payment. Jesse Jones, Lancaster, Pennsylvania.

1936 CUB: 6 months old, condition guarantneed like new; cabin enclosure, etc. Yellow with black trim. Save money, buy now. $925. John Abiuso, Airport, Sunbury, Pa.

DE LUXE CUB: 195 hours. 7 months old. Guaranteed perfect. $975. $400 down. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

TAYLOR CUB: 1935 Model, A-40-3 Continental engine; never damaged, excellent condition. $745. Louisville Flying Service, Inc., Louisville, Kentucky.

NEW CUB A-40-4: Blue and yellow; four months old, $1,085. Cub E-2, enclosure, silver and red, $750. Foster A. Lane, Port Columbus, Columbus, Ohio.

1936 CUB DEMONSTRATOR: Like new, $990. 1935 Cub, overhauled and relicensed, $750. Other bargains, three-place jobs, cabin planes; can finance. Write us. Bennett Air Service, Hightstown ("Cubtown"), New Jersey.

TAYLOR CUB: Motor A-40-2; latest changes; 150 hours. Licensed. Recovered and perfect. Foreclosure; to best offer immediately. Stored Alliance, Ohio. R. V. Trader, General Delivery, Baltimore, Maryland.

TAYLOR CUB: J-2 demonstrator. New November 1936. Enclosure and Goodyear wheels. A-40-4 engine. Ship like new. Can finance. Write P. O. Box 464, Hempstead, New York.

TAYLOR CUB E-2: Motor just majored, new prop; blue and yellow. Never cracked. Has been constantly maintained and is excellent throughout. $800. Boulevard Airport, Roosevelt Blvd., Philadelphia, Pennsylvania.

FOR SALE: 1935 Taylor Cub. Total time 420 hours; motor just majored, fabric excellent; carburetor heater, enclosure, extras. Price, $850. Also 1934 Taylor Cub, total time 400 hours, fabric good, motor just majored. carburetor heater, enclosure. Price, $800. Parrish Flying Service, Box 243, Columbia, S. C.

### *Cunningham-Hall*

CUNNINGHAM-HALL: Six-place, all metal construction biplane. Cost $16,000. Total time 125 hours. Outperforms anything built. Condition like new. Price, $2,000. Will finance half. Suitable for floats. Alaska finance accepted. Aviation Finance Co., Hemlock, New York.

### *Curtiss Robin*

CHALLENGER ROBIN: Licensed to September 1937. Never cracked; always hangared. Steel propeller, tail wheel, airwheels, brakes. Sacrifice, $850. Also licensed Standard D-25. AERO DIGEST, Box 2512.

CHALLENGER ROBIN: Licensed to November 1938. Curtiss Reed propeller, tailwheel. Only 81 hours since engine major. $895. $445 down. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

CHALLENGER ROBIN: 185 hp motor, just majored; new airwheels, new upholstery, air starter, steel propeller. Accept light car or airplane on trade. Can finance. Central Air Service, Inc., Grand Rapids, Michigan.

FOR SALE OR TRADE: Dandy Challenger Robin with new engine and covering. Will accept plane suitable for training in on trade, preferably Cub. Also have pair axles, 30 x 5 Bendix wheels, radiator, cowling and motor mount for OX Robin and some Curtiss Junior parts. Fred C. Valentin, Marion, Illinois.

FOUR-PLACE Challenger Robin: High-gloss, hand-rubbed finish, perfect condition. An unusual passenger carrying ship. Must be seen to be appreciated. Will finance or take trade. $1,095. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

### *Curtiss-Wright*

CURTISS JR. for sale: Motor majored by A & E mechanic. New tire. Licensed till August 15, 1937. $385. O. L. King, 112 Main, Seminole, Oklahoma.

CURTISS-WRIGHT Air Sedan: Excellent condition, just relicensed. Air Activities, Inc., Municipal Airport, Houston, Texas.

CURTISS JR.: Completely rebuilt. New tires, covering, paint, prop. Latest motor, majored; new steel cylinders. Licensed November. $450. Motorcycle, car accepted part payment. Trade for Klemm, Moth; Aeronca floats. Sadi Fajardo, 56 West 125th Street, New York, N. Y.

### *Davis*

DAVIS: LeBlond 65. 8 hours since major overhaul. Airplane completely gone over. Fabric like new. Private party. $775. Roy Adkins, Harlem Airport, Chicago, Illinois.

### *Eaglerock*

EAGLEROCK HISSO: Ship and motor just completely major overhauled, including new covering. $495. $295 down. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

EAGLEROCK: Model A-2, OX-5; excellent condition. Stressed up to 220 hp. Recently recovered. 30 x 5 wheels, Flottorp propeller. Accept late model car on deal. Central Air Service, Inc., Grand Rapids, Michigan.

EAGLEROCK: Challenger; 3POLB. Starter, brakes, steel propeller, dual control; licensed till July 1937. 250 hours. Original finish. A bargain for $900. E. F. Pugh, care of Bishop Chevrolet Co., Frederick, Oklahoma.

### *Fairchild*

FAIRCHILD KR-34: 3-place open, powered with Wright J6-5 175 hp, equipped with dual control, brakes, steel propeller, inertia starter; privately owned. C. Descomb, Crystal Drive, Wethersfield, Connecticut.

KR-31 FAIRCHILD: OX-5. Extra motor; new prop. Priced very reasonably. Write for details. All letters answered. Lester Simon, 316 Tyler Avenue, Ridgway, Pennsylvania.

BEST 7-PASSENGER Fairchild 71 seaplane in East; Large pay load; supercharged Wasp SC-1, completely rebuilt at Pratt & Whitney factory in August; Eclipse electric starter and generator; new special type propeller; photographic apertures; landing flares; landing gear and wheels, etc. Wasp propellers; Wasp B, total time, 550. AERO DIGEST, Box 2504.

FOR SALE: Fairchild 24, excellent condition. 1933 model. Motor 125 hp Warner, speed ring, semi-airwheels, brakes, tail wheel, starter, etc. Reasonable; $2,500. S. Cavalier, Atlantic City Airport, Atlantic City, N. J. Phone 4-9172.

FAIRCHILD KR-34: Wright 175, Hamilton steel prop. Ship covered new May 1936. Painted cream, red trim. Tail wheel, brakes, etc. $1,200. Jeter Cox, Concord, North Carolina.

FAIRCHILD 22: Wright Gipsy motor. New February 1935. 132 hours, perfect shape, privately owned. $2,295. Geo. D. Beyer, Bridgeport, Nebraska.

FOR SALE: Fairchild "24". Six months old. Like new. Blind instruments, radio, etc. Sacrifice. Bennett Aircraft, Love Field, Dallas, Texas.

FAIRCHILD 24: Warner. Late 1934. Excellent condition. Starter, wheel pants. Always privately owned. An unusual buy. $2,975. Will finance or take trade. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

1936 RANGER POWERED Fairchild 24: 100 hours; perfect. Air Activities, Inc., Municipal Airport, Houston, Texas.

FAIRCHILD 24: Practically new 1936 demonstrator. Substantial reduction. Fokker Amphibion, 575 hp Hornet, 94 hours since major. Also new Hornet cylinder. Weddell & Smith, Fairchild Distributors, City Airport, Detroit, Michigan.

FAIRCHILD KR-31: OX-5. Complete set instruments, full air wheels, new mail type windshield. One of the best flying OX jobs ever built. $495, or less with standard wheels. Can finance 50%. John T. Corrodi, Inc., Box 185, Bexley Station, Columbus, Ohio.

### *Fleet*

FLEET MODEL 2: $1,350. Late 1935 Cub, $850. Salmson Eaglet, $525. All licensed, in A-1 condition. The Fleet and Eaglet recovered last Spring. Charles R. Spaulding, Framingham Airport, Massachusetts.

### *Great Lakes*

GREAT LAKES 2T1A: New engine and special equipment: landing lights, navigation lights, wheel pants, brakes, bank and turn, front cockpit cover and mail type windshields. Condition excellent throughout. $1,200. Can finance 50%. John T. Corrodi, Inc., Box 185, Bexley Station, Columbus, Ohio.

GREAT LAKES 2T1A: Snappy cream and black; pants, steel prop, extra Cirrus Mark III. $985 takes all. Will trade and finance. J. A. Simcock, Front and Roosevelt Blvd., Philadelphia, Pennsylvania.

### *Hammond*

FOR SALE OR TRADE: 100 Kinner Hammond 3-place. Wanted for cash, regardless condition, airplanes and motors. Will trade 1935 Plymouth sedan, sound system in rear seat. A. J. Hartman, Burlington, Iowa.

### *Inland*

INLAND SPORT: High wing monoplane, side by side. LeBlond 70. Excellent condition. Licensed November 1937. $725. Driggs Rover, $975. A. E. Hultzen, 843 N. Pine Avenue, Chicago, Illinois.

### *Laird*

LAIRD, WRIGHT 330: Only 197 hours guaranteed time since new. Beautiful high-gloss finish. Turn and bank, rate of climb, electric starter. $2,750. Will finance or take trade. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

### *Lincoln-Paige*

DE LUXE LINCOLN PAGE Trainer: Semi-airwheels, air speed, compass, new Fahlin prop; high gloss finish. Licensed till October. OX-5 engine. $425. Accept trades. Elwin Carlson, Harcourt, Iowa.

### *Lockheed*

LOCKHEED VEGA: J-5 five-place, ship and motor completely overhauled; starter, generator, two-way radio, full instruments, landing lights, flares, airwheels, tail wheel, new leather upholstery. Lewis Air Service, Union Air Terminal, Burbank, California.

### *Loening*

FOR SALE: Privately owned Loening Commuter. Licensed. 75 hours since J-6 300 completely majored by factory representatives, including all modernizations. Flares, landing lights, and extra instruments. Light gray hull, yellow wings. Good value. Ship may be seen at Port Washington Seaplane Base or call Port Washington 225 R, Long Island, N. Y.

### *Monocoupe*

VELIE MONOCOUPE: 65 hp. A-1 shape. 276 hours on ship. $500 for a quick sale. Harry Johnson, 212 Charles Street, Jamestown, New York.

MONOCOUPE LAMBERT 90: 1934. Pants, new battery, navigation lights; never cracked, like new. Total time, 370 hours. 10 hours since complete overhaul. Price, $1,850. Columbia Airways, Bloomsburg, Pennsylvania.

MONOCOUPE 1936: 90-A de luxe. Many extras. R C A receiver. Total time, 160 hours. Factory new condition. Sacrifice for cash at about half original cost. AERO DIGEST, Box 2513.

MONOCOUPE: Powered with Warner Super Scarab 145 hp motor. Time less than 200 hours since new. Equipped for night flying. Bonded, shielded for radio. Radio receiver installed. Tunnel cowling. Very clean. Becker-Forner Flying Service, Inc., Jackson, Michigan.

FOR SALE: Late model D-145 Monocoupe, powered with 145 hp Warner motor. Equipped for night flying, also radio equipped. Built to cruise 140 mph. Top 160. Well streamlined. Price, $2,850. AERO DIGEST, Box 2518.

MONOCOUPE: Lambert 90. Purchased October 1936. Delivered in Philadelphia, then flown seven hours. Equipment includes starter, generator, landing lights, bank and turn, rate of climb, thermocouple, clock, emergency release both doors. Painted black with yellow trim. A new plane, 25% off price. Boulevard Airport, Roosevelt Blvd., Philadelphia, Pennsylvania.

LAMBERT MONOCOUPE: 335 hours total time. 73:00 hours on engine since complete major. Airplane recovered and finished in high lustre throughout. Special equipment, left door, engine cowling, wheel pants; tail wheel, special upholstering and clock. $2,050. Can finance 50%. John T. Corrodi, Inc., Box 185, Bexley Station, Columbus, Ohio.

### *Moth*

DH MOTH: Just recovered; motor overhauled; licensed in October. Priced to sell. Chicago Aviation Corporation, Glenview, Illinois.

GIPSY MOTH: Just recovered. Airplane and engine perfect. $695. $350 down. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

### *N-B Trainer*

BARLING NB-3: Powered Genet engine. Engine just majored, airplane completely recovered, reupholstered, just relicensed three-place. Excellent for training and passenger work. $795. $397.50 down. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

### *New Standard*

J-5 STANDARD: Excellent motor, fabric good, steel propeller, direct electric starter, landing lights, flares. Air Tours, Inc., Put in Bay, Ohio.

D-25 NEW STANDARD: J-5 motor. 52 hours since major. Steel prop, tail wheel, etc. Just relicensed. Can finance. $1,350 cash. "Al" Leeward, New Kensington, Pennsylvania.

### *Pitcairn Autogiro*

PITCAIRN AUTOGIRO: Kinner 160. Both almost new. 200 hours total, 20 since overhaul. Steel propeller, air starter, brakes. $1,075. Will trade; sell motor or plane. Kenneth Wise, 4618 Grove, Oakland, California.

### *Porterfield*

1936 PORTERFIELD LeBlond 70 demonstrator: 10 months old. Air speed indicator, speed ring; perfect condition. Price, $1,400. John H. Hoffman, 1323 Astruria Avenue, Coral Gables, Florida.

BRAND NEW Porterfield: LeBlond powered. Many extras. Big discount. Bennett Aircraft, Love Field, Dallas, Texas.

PORTERFIELD: Here is an unusual buy in a light airplane. Fabric and engine perfect. 250 hours total time. $995. $450 down. Don't be fooled by the low price. This ship is a bargain. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

### *Ryan*

RYAN B-3 J6-9: 6-place. Twenty hours since majored. Covering year old. New tires; prop etched. Fast job. Get in and out of any field. $1,495; light ship in trade; terms. E. C. Bearden, 24 East High Street, Lawrenceburg, Indiana.

### *Rearwin*

REARWIN SPORTSTER: Built September 1935. Powered with LeBlond 70. Only 250 hours total time. Guaranteed perfect. $1,595. $795 down. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

REARWIN SPORTSTER: De luxe model 8500; 85 hp LeBlond. New October 1st. Less than 65 hours total. Same as new. $350 extra equipment. $2,475 or will consider trades. Robins preferred. Art Walters, Baker, Oregon.

### *Simplex*

SIMPLEX MONOPLANE: K-5 Kinner powered. 2-place, side-by-side, with dual controls, speed ring, airwheels, new prop. Licensed to August 1937. Total time on ship and engine, 170 hours. Always hangared and in perfect condition. Fast and very maneuverable. Photos on request. $950. Guy Gully, Sharon, Pennsylvania.

### *Spartan*

SPARTAN LOW WING: Side-by-side, powered 55 hp Jacobs; compass. Fuselage and wings need recovering before relicensing. Last majored at Jacobs plant. $500 cash. C. S. Bruce, 1725 Lanier Place, N. W., Washington, D. C.

### *Star*

STAR CAVALIER: Lambert engine. Purchased three months ago from Bartlesville factory. 300 hours total time. 40 hours since major at factory. Paint and upholstery in splendid condition. $875 cash. E. Van, Municipal Airport, Oklahoma City, Oklahoma.

### *Stearman*

STEARMAN C-3-B: J-5 motor; total time 620 hours; 40 hours since major overhaul; bank and turn, rate of climb, steel propeller, clock, navigation and instrument panel lights, battery, compass, altimeter in front seat; excellent condition, $1,200. Muncie Aviation Corporation, Muncie, Indiana.

STEARMAN C-3-R: J6-7. New covering, motor majored, full instruments front and rear for blind flight training, radio, hood, airwheels, tail wheel, parking brake, starter, generator. Lewis Air Service, Union Air Terminal, Burbank, California.

### *Stinson*

STINSON "R": Engine only 10 hours since complete major, including new master rod bearing. Ship just repainted red and black; new carpets; blind flying hood. Instruments just overhauled; include bank and turn, rate of climb, sensitive altimeter, directional gyro. Generator, landing lights, flares and large tanks. $2,650. Eastern Aeronautical Corporation, Newark Airport, Newark, New Jersey.

WE HAVE STINSONS of all models from 1930 to 1936. Will trade or finance. 1934 Stinson, needs rebuilding; fuselage and landing gear and tail okay; will sell with or without engine. Total time 140 hours. Chicago Aviation Corporation, Glenview, Illinois.

1936 GULLWING STINSON: Radio compass, gyro instruments, 35-watt transmitter, generator, controllable pitch propeller, lights and flares. Less than 100 hours total time; never damaged. Will sell with or without special equipment. Chicago Aviation Corporation, Glenview, Illinois.

STINSON SM8A: Lycoming; relicensed January 4th. Semi-airwheels, large retractable landing lights, electric starter, speed ring, new DuPont upholstery. Priced to sell. D. W. Young, 311 North 36th Avenue, Omaha, Nebraska.

STINSON EXECUTIVE Reliant 1933: 70 hours since factory major on motor; complete blind and night equipment. Two-way radio. $3,350. M. E. Graham, Erie, Pennsylvania.

STINSON 1934: Privately owned; Smith controllable propeller, flaps, rate of climb, turn and bank, carburetor air temperature, manifold pressure, thermocouple, compass, clock, R C A radio, landing lights, flares, brand new cactus-proof tires, 75-gallon tanks, genuine leather upholstery; flown 325 hours; engine just majored; no time since. Write owner care AERO DIGEST, Box 2524.

DE LUXE STINSON R: Very clean and in best of condition. J-5 2000 Travel Air, new cover. Inquire: Harold Eddington, 2443 30th Street, Rock Island, Illinois.

STINSON SM2AA: J6-5. Licensed to July. Steel propeller, Heywood starter, rate of climb. Engine perfect, with 185 hours since major. $1,025. Will trade. E. A. Skroch, Minot, North Dakota.

STINSON SR6: Late 1935 model. R-680-6 Lycoming 245 hp motor, controllable pitch propeller, thermocouple, radio bonded and shielded, R C A radio, turn and bank indicator, Kollsman sensitive altimeter, Sperry directional gyro, flares, landing lights, 75-gallon gas tanks, floor camera door, parachute door. Cost extra equipment, $2,281.50. Total time 312 hours, 67 hours since factory motor overhaul. Plane waxed and in excellent condition. Licensed to September 1937. $5,500 cash. Smith Flying Service, Wilkes-Barre Wyoming Valley Airport, Forty-Fort, Pennsylvania.

1935 SR-6: Privately owned Stinson Reliant—NC-15122, $5,885; cost nearly $9,000 with extras, including standard instruments plus Kollsman sensitive altimeter, Smith controllable propeller, 100-gallon tanks, flares, landing lights, R C A radio, turn and bank, red and cream finish with matching red leather upholstery. Purchased new from Stinson September 1935; never cracked; flown by one pilot only; maintained without regard for cost; used for personal travel only. M. Reynolds, 542 S. Dearborn Street, Chicago, Illinois.

WILL SELL OR TRADE for Monocoupe: 1934 Stinson, full set instruments, radio, Hamilton controllable propeller; motor just majored by airline; price, $4,500. Also Stinson SM8A, excellent condition, $1,350. Write J. B. Lee, P. O. Box 207, Augusta, Georgia.

STINSON RELIANT: '33 model, completely bonded, shielded for radio. Radio receiver installed. Also fully equipped for night flying. Excellent condition. Terms. Edw. A. Forner, Jackson, Michigan.

J6-7 STINSON: Just completely recovered and newly upholstered. Engine just majored and modernized. An unusual buy in an airplane in perfect condition. $1,675. $875 down. Will take trade. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

TRIMOTORED STINSON Airliner: Complete and blind flying equipment. Radio, electric starters. Licensed to August 1937. $2,650. Will finance or take trade. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

TWO SM1F STINSONS: 6-place, 330 hp Wright D motors, recently majored. A-1 condition throughout. Large load capacity and moneymakers for barnstormers. Airwheels. Trade in your airplane or light car. Priced to sell. Terms. Central Air Service, Inc., Grand Rapids, Michigan.

STINSON: Warner powered. Excellent performer. Just relicensed. Sacrifice, $795. Capitol Airport, Bladensburg, Maryland.

STINSON MODEL SR-6: Equipped with radio, standard flight instruments, Smith controllable propeller, Lycoming 225 hp engine; used very little; $4,900. AERO DIGEST, Box 2519.

STINSON SM8A: Licensed to May 1937. High luster finish. Steel propeller, generator, starter. $1,395. $675 down. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

STINSON RELIANT SR-5: Manufactured November 1934; excellent condition. never damaged. High polish finish. $3,250. Louisville Flying Service, Inc., Louisville, Kentucky.

1934 STINSON SR-5A: Serial No. 9283. Controllable and flaps. Just majored Lycoming plant, one week ago. Fully equipped night and blind flying. Excellent condition. Bruce Gimbel, 611 Fifth Avenue, New York, N. Y.

### *Travel Air*

4000 TRAVEL AIR: 165 Comet. Latest type steel prop. Brakes both cockpits. Tailwheel. Many instruments. Excellent condition. Just relicensed. $975. Terms or trade. Many others; good buys. Gordon Box, Taft, California.

TRAVEL AIR 4000-W: Warner Scarab. Licensed; standard instruments; airwheels. Beautiful ship perfect in every respect; very economical. A steal at $850 cash. Phil Dunklin, Nashville, Arkansas.

FOR SALE: Travel Air OX-5. New motor, ship in perfect condition. Black fuselage; gold wings. Licensed to November 1937. Fly away. $600. Ship at Mt. Hawley Airport, Peoria, Ill. Write or wire Leo Jackson, Hamilton Hotel, Bloomington, Illinois.

TWO J-5 4000 TRAVEL AIRS: Both just licensed for two passengers and pilot. Condition guaranteed perfect. Will make excellent dusters. Terms. J-5 parts very cheap. Pioneer instruments just reconditioned. Small trailer to carry complete aircraft engine. R. C. Downing, Parks Air College, East St. Louis, Illinois.

TRAVEL AIR 2000: Just relicensed. OXX-6 motor major overhauled. Ship in perfect condition. never cracked. $550 cash. Bill Truax, Box 1166, Hattiesburg, Mississippi.

### *Waco*

WARNER WACO F: Newly majored and covered. In perfect shape. $1,450. Witch Duck Aeroplane Corporation, 248 Bank Street, Norfolk, Virginia.

WACO CABIN: December, 1931; 165 Continental. New blue leather upholstering. Turn bank, steel prop, Heywood starter. Just relicensed; $1,750. Army receivers and transmitters, $35 each. Odell Garrison, Municipal Airport, Birmingham, Alabama.

WACO 10: OXX-6. Compass, airwheels, motor perfect; needs covering only to be relicensed. $375. Would like to trade with cash on air-cooled job not over $1,000. Stewart Lindke, Croswell, Michigan.

WACO 1934 CABIN: Jacobs 225. Less than 300 hours. Motor converted and majored. Radio, lights, flares, bank and turn, rate of climb, 70 gallons gas capacity; outside temperature, thermocoupe, Jaeger chronoflite clock. Must sell quick, therefore real bargain. Condition extra good. The H. C. Robbins, Company, Waco Distributors, Cleveland Airport, Cleveland, Ohio.

WACO DSO: 180 Hisso. Late model, NC-629N; licensed to July '37. 30 hours on motor since major. Brakes, tail wheel. Excellent condition. Not one cent to be spent for repairs. $850 cash. Murray C. Taylor, 112 Sunset Place, Latonia, Kentucky.

1935 WACO CUSTOM CABIN with 285 Wright and Hamilton Standard controllable pitch propeller, 250 hours. Perfect condition. All standard instruments plus directional gyro, bank and turn, rate of climb, sensitive altimeter, manifold pressure, clock, outside air and head temperature gauges; R C A receiver; landing light; flares; and 95-gallon gas capacity. Beautifully upholstered with the finest Goodall-Sanford plush. Price, $5,900. Goodall Company, Cincinnati, Ohio.

1934 CABIN WACO: 210 hp Continental motor; lights, flares, and radio. Priced below the market. Chicago Aviation Corporation, Glenview, Illinois.

WACO 210 HP CONTINENTAL F-2: Waco 225 hp Jacobs F-5; Waco 225 hp Jacobs 5-passenger cabin. All ships perfect, exceptional values, and very outstanding in their class. Many extras. Paul Peterson, 2503 Union Avenue, Altoona, Pennsylvania.

WACO GXE: Licensed, A-1. Airwheels, duals, OX-5 major overhauled; 1400 rpm. New Thompson valves, Miller action, spinner. Priced right. Tinsley Smith, 1227 Broad, Nashville, Tennessee.

WACO J6-5: Licensed to October 1937. Waco 10. Millerized OX. No time since recovered. Must sell at once. Ed Bickle, 301 South 38th Avenue, Omaha, Nebraska.

WACO A: Perfect. Continental 210, modernized; steel prop, instruments, lights, pants, wing fairing. Want late Fleet, Stearman or Travel Air J-5 or 300. Portland Flying Service, Inc., Portland, Maine.

WACO 1934: De Luxe Cabin. Jacobs engine; Berry red, black trim; hand rubbed. Total time 260 hours; 30 hours since modernized and majored. 70 gallon tanks, bonded and shielded, wired for radio and flares. Has blind flying instruments, lights, seat covers. Private owner desires larger plane. Never operated commercially, never cracked, absolutely perfect, just relicensed. Easily worth $3,500; best offer takes it. Ideal Manufacturing Company, 3012 Macauley Street, Saginaw, Michigan.

WACO A: Late '32. 170 hp Jacobs. Radio, starter, turn and bank, position and landing lights, winter enclosure, excellent finish and covering. $1,700. J. W. Lytle, 2333 Vodeli Street, Pittsburgh, Penna.

WACO, MILLERIZED: Now being recovered, completely refinished with best materials. $7850 $100 deposit will hold till May 1937. Waynedale Airport, Route 4, Fort Wayne, Indiana.

ONE WACO CABIN 1934: Jacobs motor, 70-gallon tanks, lights, flares, bank and turn, rate of climb, clock, radio; color Insignia blue; 200 hours since major overhaul; price, $3,200. Muncie Aviation Corporation, Muncie, Indiana.

WACO CABIN: Late 1932. Continental 210; bank and turn, rate of climb, landing lights, flares, radio, ambulance, steel propeller, leather upholstery, $1,800. Muncie Aviation Corporation, Muncie, Indiana.

WACO F-2 CONTINENTAL 165: Completely recovered. Berryloid hand-rubbed finish. special color combination. Engine excellent condition. Steel propeller like new standard instruments, ring, starter, military windshield, etc. $1,875. John Abiuso, Airport, Sunbury, Pa.

WACO 1934: 225 Continental. Modernized at factory. 81 hours since complete major. Bargain. Bennett Aircraft, Love Field, Dallas, Texas.

WACO CABIN: 1934, like new. Jacobs 275, modernized; full set instruments. radio, pants, flares, Reed prop. $3,600. Red Bank Airport, Red Bank, N. J. Phone: 1730.

WACO F-2: Jacobs 170 hp motor. Hamilton steel propeller. Ship thoroughly inspected by Department of Commerce and relicensed to December 1937. Condition of motor and ship absolutely perfect. 100% all around. Must be sold by business man who has no time to fly. Priced to sell at a figure you can pay. See me at once. Buster Warner, Erickson & Remmert, Floyd Bennett Field, Brooklyn, New York.

WACO GXE: Licensed to January 1938. New Scintilla magnetos. Fabric perfect. $475. $275 down. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

WACO STRAIGHTWING J6-5: 3-place, modernized. Just recovered and licensed. An excellent performer, in excellent condition. $1,100. Boulevard Airport, Roosevelt Blvd., Philadelphia, Penna.

WACO YKC: De luxe; Jacobs 225; like new; one owner; radio; full instruments; 220 hours; 8 since factory overhaul. Never damaged. Aviation Service Co., Hartford, Connecticut.

1934 WRIGHT WACO de luxe: Air brakes, complete night and blind flying equipment, including radio receiver; no time since complete recover, refinish and major. Air Activities, Inc., Municipal Airport, Houston, Texas.

WACO CABIN: 210 Continental. Landing lights; leather upholstery; five flares; ambulance attachments; rate of climb, turn and bank, etc. Owner leaving for Europe. For immediate sale, $2,250. For demonstration and details address B. C. Dempsey, 340 Walnut Street, Winnetka, Illinois.

1933 WACO DE LUXE Cabin: Continental 210 hp. Hours since major, 103. Large tanks, radio, pants, all lights, extra instruments. $2,195. Can finance. "Al" Leeward, New Kensington, Pennsylvania.

FOR SALE: Waco cabin model UXE, manufactured late 1932. Total time, 340 hours; like new throughout. Semi-air wheels, Heywood starter, turn and bank, rate of climb, dual control wheels, many extras. Always privately owned and hangared. Price, $2,500. Parrish Flying Service, Box 243, Columbia, S. C.

WACO CUSTOM CABIN: Jacobs 225 hp demonstrater. Wonderful condition. Extras include: bank and turn, rate of climb, RCA receiver, lights, flares, 70-gallon gas tanks. Cost over $7,700. Must sell to make room for new models. Must be seen to be appreciated. Priced to sell quick. The H. C. Robbins Company, Waco Distributors, Cleveland Airport, Cleveland, Ohio.

## *Miscellaneous Aircraft*

FOR SALE: One Davis D-1, $800. One C-3 Aeronca '34, $800. Two Great Lakes 2T1A, each $900. The above ships are in excellent condition. Ann Arbor Air Service, Ann Arbor, Michigan.

STINSON SM8A: Black fuselage, black and yellow diagonally striped wings; motor 65 hours since major and complete modernization; landing lights and standard instuments. Aristocrat, powered with Wright J6-5, fair condition, excellent buy for someone. Waco C, 1932, excellent condition; powered with Continental 165 with 8 hours since complete major; just relicensed. Travel Air 2000, excellent condition; powered with Wright J6-5-E engine, 190 hours since new; starter, brakes and new set of tires, bank and turn, black fuselage and orange wings. Travel Air 2000, excellent condition, just relicensed; blue fuselage and orange wings; powered with Wright J6-7 with two hours on motor since top overhaul; full airwheels and extra gas tank. Ship and motor excellent condition. Cannon-Nelson Aircraft, Charlotte Airport, Charlotte, North Carolina.

FOR IMMEDIATE SALE: The following licensed airplanes. 1933 De Luxe Stinson Reliant, many extras. J6-9 S-6000-B Travel Air, extras. 1935 E-2 Cub. J-5 Stearman. Kinner-powered Taylor Chummy. Taper wing Fairchild KR-21. For further details communicate with Camel City Flying Service, Inc., Box 1941, Winston-Salem, North Carolina.

BARGAINS IN RECONDITIONED PLANES: OX-5 Waco, $325; OX-5 Pheasant, $375; Taylor Cub, one year old, just overhauled, $850; Stinson S, Fleet, Great Lakes, Stearman (Wasp Jr.). Trades accepted and terms. Aero-Ways, Inc., Cleveland Airport, Cleveland, Ohio.

AIRPLANES, MOTORS: Hundreds of bargains. Catalog with names, addresses of owners sent postpaid, 25c. Forx Air Service, 124 Belmont Road, Grand Forks, North Dakota.

CURTISS WRIGHT SEDAN: 185 Challenger, $1,150. OX-5 Eaglerock A-2, new covers, $375. Hisso Eaglerock, brakes, $450; steel runners, skis. G. O. Imm, Fergus Falls, Minnesota.

TWO 1936 MODEL C-34 Cessna Demonstrators: Special paint and upholstery. Both planes like new and carry factory guarantee. Kinner Playboy: 160 hp motor. Total time 220 hours. Ship and motor like new. Will trade. Big bargain. 125 hp Warner Monocoupe: Semi-airwheels. Steel propeller, electric starter; shielding and bonding and radio. Motor just overhauled. Beautiful ship. Big bargain. Model SM8A Stinson: Ship and motor in best of condition. Price, $1,295. Challenger Travel Air: Perfect condition, $1,250. J6-7 Beechcraft: Has very best of care. Gyro and complete blind flying equipment. Ship cost over $15,000; our price, $7,000. Will consider trade on late model used automobiles or other airplanes. Cessna Aircraft Company, Wichita, Kansas.

FOR SALE OR TRADE: Kinner American Eagle; 1-2-place low wing monoplane. Genet motor. Both ships identified, in flying condition. Prefer Cub or Robin. Grady Montgomery, Jackson, Tennessee.

STINSON SM8A: $600 down. Waco F, $500 down. J-5 Fairchild cabin, $450 down. Taylor Cub, $250 down. Aeronca, $185 down. Kinner Bird, Warner Monosport, J6-5 Stinson, Curtiss Sedan, Waco Taperwing, Pitcairn, $500 down. Siemens Cessna, Travel Air, Warner Commandaire, Great Lakes, $400 down. Stinson Reliant, Stinson R, Stinson Trimotor, $1,000 down. Avro-Avian, $350 down. OX Travel Air, Wacos, Robins, $200 down. Curtiss Junior, $150 down. We buy, sell, trade all type airplanes, including used parts, supplies, pontoons, etc., Pioneer Aviation, Airport, Syracuse, N. Y.

GREAT LAKES: Motor majored, plane recovered with high gloss finish, $1,000. Davis LeBlond 65, just majored, plane recovered, new propeller, $800. New Cub, $1,000. Barling (identified), LeBlond 65 majored, ship never cracked, $350. Calumet Air Service, Gary Airport, Gary, Indiana.

J-5 A2 EAGLEROCK: Licensed to December 1937; motor top overhauled under 500 total hours. Hamilton adjustable steel propeller, starter, booster, Pioneer air speed, turn and bank, compass, special clock, all other standard instruments; new pyralin; new 900 x 12 Goodrich tires, brakes; extra tire and axle; 70-gallon gas capacity; performance and condition excellent; $1,095; can be partly financed to responsible party. Robin OX-5: Completely Millerized, licensed to December 1937. High compression pistons, turns 1424 on ground. Standard instruments, including air speed, compass, landing lights, oleo landing gear, new Goodrich tires, extra axle and wheels. Ship just completely overhauled: new cables, pyralin, etc. Performance and condition perfect. $575 cash. Wally's Flying Service, Airport, Grand Junction, Colorado.

AERONCA C-3: Motor E-113-A; winter enclosure, cabin heater; air speed, thermocouple; navigation lights, streamline landing gear with brakes. Clean job. Cash, $925. Monocoupe Lambert 90-A: De Luxe; flaps; extra wide landing gear with pants; thermocouple, extra instruments; steel prop, heater, all red. Total time 250. Cash, $2,400. Travel Air J-6 250 and Challenger Robin: Best in country. Also, reasonably priced NAR3 carb, PN5 magneto, Velie, DH Gipsy and Challenger parts; 36 x 8, 40 x 10 tires; 44 x 10 tires, tubes, wheels with brakes; Fledgling ailerons, aluminum and streamline tubing; oil cooler, new; Wasp motor mount ring; miscellaneous instruments and switches: aluminum gas tanks, new Breeze spark plug shields; Western Electric 563A headphones. Hadley Aircraft, Inc., Hadley Airport, New Brunswick, New Jersey.

CHALLENGER FLEDGLING: Bank turn, rate climb, instruments both cockpits, spare motor and prop hood; licensed, wired for radio; yellow fuselage, silver wings; A-1 shape. $850. Warner Monocoupe: Phoebe Omlie's "Miss Memphis"; $1,250. Mid-South Airways, Memphis, Tennessee.

'34 WACO CABIN, Jacobs; '34 Stinson Reliant; 225 Jacobs Beechcraft; '36 Lambert Monocoupe; '35 3-place Warner Fairchild; Bellanca Skyrocket; Rearwin Sportster, new, 85 LeBlond; J6-7 Travel Air; Stinson SM8A. Aircraft Sales Co., Hangar D, Roosevelt Field, Mineola, New York.

SPORTPLANES: $55 up. OX jobs, $100 up. Hundreds of others. Terms. Big winter directory, just out. Rushed anywhere for 25c, postpaid. Used Aircraft Directory, Athens, Ohio.

REPOSSESSED Porterfields, Cubs, Ryan B-1, Wallace, Kinner B-5 Bird, Aeronca, Challenger and Eaglerock OX-5's. Aeromarine Klemm and Stinson SR-5 airplanes. J6-7, Kinner, Continental A-40-2 Cirrus Mark III motors. Airplane parts for Moths, Avians, Stinsons and American Eagles. Small down payment and balance monthly on anything we have. Motors and planes repaired on finance plan. Write Aviation Finance Co., Hemlock, N. Y.

VERVILLE AIR-COACH: J6-7 engine, just majored; perfect, clean; night equipment. Outperforms SM8A; goes 18,000 feet. $1,195. Eaglerock Comet: Perfect, steel propeller, brakes; best offer over $550 takes. Engines: J6-5, $295. J6-7, $450. Comet 165 hp, $175. Semi-airwheels, 8.50 x 10, brakes, $60. Warner parts. Buck, Stratford Apartments, Madison, Wisconsin.

19 CERTIFIED AIRPLANES for sale or exchange: Warner 145 hp Monocoupe, late model; J-5 Speedwing Travel Air; B-5 330 hp 6-place Ryan; J-5 220 hp 3-place Laird; J6-9 330 hp 6-place Stinson; PA-8 Pitcairn Mailwing, less 330 hp motor; 2 OX-5 Waco 90's; 2 OX-5 Travel Airs; Lycoming-powered Stinson Jr., equipped for night flying, includes radio; Bellanca Pacemaker, powered with Wright 330 hp E-type motor, equipped for night flying, also radio; J6-7 250 hp 3-place Travel Air; J6-9 330 hp 6-place Travel Air; OX-5 Robin; J-5 6-place Stinson; OX-5 Laird. Late model cars accepted. Deals financed. Becker-Forner Flying Service, Inc., Jackson, Michigan.

BUY NOW: 15 excellent airplanes. Two Wright J6-9 Stinsons, 6-place. Two Driggs Skylarks, one nearly new. Two J-5 Travel Airs. J-5 Waco, Lambert-powered Cavalier Coupe, Challenger Robin, air starter, new airwheels. Taylor Cub, Aeronca C-3, Waco OX recently reconditioned, two OX Travel Airs, OX Eaglerock stressed for J-5. Trade in your car or airplane. Can finance. Write for details. Central Air Service, Inc., Grand Rapids, Michigan.

CURTISS-WRIGHT Travel Air 16-K: 3-place, relicensed. All new heads, $1,375. Spartan low wing, Jacobs 55, majored and relicensed, $900. Foster A. Lane, Port Columbus, Columbus, Ohio.

GEE BEE K-5: 2-place; best offer; 1936 Cub demonstrator; Stinson SM8A; 1934 Stinson Reliant de luxe, like new; others. Parachutes, plugs, magnetos, parts. Aviation Service Co., Hartford, Conn.

1936 LYCOMING STINSON: Special cream paint job; landing lights; 350 hours. 1936 J-2 Cub, completely rebuilt. Taylor Aircraft Company, Bradford, Penna.

AMERICAN EAGLE OX-5: Engine practically new, plane in excellent condition. Licensed to September 1937. $350 or trade for good car. 201 Eagle, good condition, $600. LeBlond Rearwin, 25 hours since engine overhauled, $1,400. Also have three cylinders with only 60 hours service for 240 hp Lycoming, just clean up to .02 oversize. Make offer. Mel Swanson, Minneapolis Airport, Minneapolis, Minnesota.

CLEAN OUT SALE: Look at these bargains! Aeromarine Cub, 125 hours on motor, 75 hours since ship completely recovered at factory; $595. Continental Cub, 40 hours since major, 150 hours since ship recovered; $575. OX-5 Air King, flyable, identified, $195. Velie Monocoupe, oleo landing gear, good ship; $395. Henderson Heath, probably best Heath in country, $325. Waco 90: good ship and good motor, air wheels; $465. 1934 Stinson SR-5, beautiful ship, $2,750. 1932 Warner Monocoupe, probably fastest standard wing job in country, special cowl, pants and streamlining, $1,650. Will trade and sell on terms. Don't write—telephone or wire. Neil R. McCray, Fairview, Pa. Ten miles west of Erie.

PLANES FOR SALE: Laird Speedwing, Wright 330; Laird Whirlwind, Wright J-6 300; Laird Whirlwind, Wright J-5 220; Laird Speedwing Jr., Ranger 120; Buhl 2-place trainer, Wright J-5. Send for complete list of used planes. E. M. Laird Airplane Company, 5917 S. Cicero Avenue, Chicago, Illinois.

FEBRUARY'S BARGAINS: Parks Ryan J6-5, 3POLB; engine time 300; very good shape. J-5 Stinson Jr., 500 hours total, excellent performer, very good shape. Cub E-2, new June 1935; excellent. OX Travel Air, licensed to October 1937. Consider trades and finance. H. B. Kaywood, General Delivery, Sanford, Florida.

FOR SALE: Ford Trimotor, 5-ATC; Wasp C engines, modernized in every way. Fully equipped electric starters, speed rings, all instruments. Absolutely perfect condition, $5,700. Ford Trimotor, 5-ATC, Wasp C engines, modernized in every way. Fully equipped electric starters, speed rings, all instruments; absolutely perfect condition, $6,500. Two Taylor Cubs, 40 hp motors, low time, $1,175 each; includes both skis and wheels. Stinson SM8A, Lycoming motor; 70 hours since major overhaul, semi-air wheels, ring, excellent condition, $1,450. Fairchild KR-21, Kinner front exhaust; 60 hours since ship recovered and motor overhauled; steel prop, speed ring, exhaust ring, eight-coat hand-rubbed finish, $1,150. American Eagle 129 Kinner, perfect condition, $700. Five-place J-5 Standard, good condition, $1,550. Ford Trimotor parts, Sikorsky parts, Hornet Model A parts, Wasp C cylinders. Write for prices. Menasco motor, slightly damaged, with steel prop; $150 as is. Two Kinner front exhaust motors, good condition, $350 each. Two J6-5 steel propellers, $75 each. Four Wiley flares, large, $15 each. Two new Butler T individual steel hangars, one 42-foot, $500; one 36-foot, $400. DePonti Aviation Company, Inc., Municipal Airport, Minneapolis, Minnesota.

## ENGINES

FOR SALE: £65 each, British R.A.F. surplus. A large number of Armstrong-Siddeley "Mongoose" 5-cylinder, left hand tractor, air-cooled radial aero motors. 150 hp at 2035 revolutions. 320 pounds weight. Complete with dual magneto ignition, carburetor and air intake, propeller hub and bolts, oil pumps and piping. Ready for installation. Packed F.O.B. London docks. Many other higher and lower powered motors for disposal. L. Anderson, Bristow Road, Hounslow, Middlesex, England.

FOR SALE: Three modernized Wasp "B" engines. Completely overhauled in Government shop. No time since test stand. Average total time about 500 hours. List of replacement parts and log with each engine. $800 each. Blanchard Air Service, Box 504, Pensacola, Florida.

FOR SALE: Warner Scarab, complete with collector ring and Hamilton Standard steel prop. 65 LeBlond. Blackwell Flying Service, Palestine, Texas.

FOR SALE: Wright J6-5 engine. No hours since major overhaul; J-6 prop, overhauled by Air Associates. AERO DIGEST, Box 2505.

BRAND NEW English Cirrus Mark II: In original cosmolene, complete; $200 for quick sale. Tred Avon Flying Service, Easton, Maryland.

LYCOMING MOTORS: Model R-680-4. 225 hp. Less than 200 hours total time. Model R-690, 215 hp. Write for prices and details. Chicago Aviation Corporation, Glenview, Illinois.

ENGLISH GIPSY: Part of crack-up, in fair shape. Grand for parts or repair; magnetos good. Cash price, $50. Eugene Smyser, 129 Maple Avenue, New Wilmington, Pennsylvania.

WASP ENGINES (5): P & W R-1340-80 and one Hornet R-1860-56. Rising Sun Motors, H and Luzerne Streets, Philadelphia, Pennsylvania.

LE BLOND 70: New series. Total time 55 hours. Reasonable. Aeronca Flying Service, Inc., Lunken Airport, Cincinnati, Ohio.

LYCOMING R-680: Just majored, no time since. Will finance total amount with no down payment. Aviation Finance Co., Hemlock, New York.

LYCOMING R680BA: 240 hp, completely overhauled and tested, equipped with starter, generator, magneto and adjustable Hamilton Standard propeller. $1,150. General Airmotive Corporation, Municipal Airport, Cleveland, Ohio.

KINNER K-5: Side, 40 hours; storage since 1930. $400. Aircraft Development Company, Washington, D. C.

ENGLISH CIRRUS MARK III: 95 horsepower. Brand new, original crate. A real buy, $275. N. W. Perdew, Teterboro Airport, Hasbrouck Heights, New Jersey.

## WANTED TO BUY OR TRADE

TRADE DESIRED on my J-5 Monocoach; ship and engine undergoing complete overhaul. New glass, new pyralin roof. Rejuvenated and refinished in black and silver. DuPont finishes used. Total time on ship, 405 hours. Carries following extra equipment: Goodyear Airwheels, tail wheel, Townend ring, Pioneer primary flight group, navigation lights, compass. Prefer trade on 285 Beechcraft, but would be interested in any good performing cabin ship of modern design. W. E. Leedy, Jr., Box 812, Wheeling, West Virginia.

AIRPLANE WANTED: Have $500. Must be licensed. No OX jobs. State full particulars in letter. D. Kelley, 1483 Wayburn, Grosse Point, Michigan.

WANT TO BUY Kinner K-5 parts, new or can be slightly used, or reconditioned. Give detailed information first letter. Lincoln Aeronautical Institute, 2415 O Street, Lincoln, Nebraska.

WANTED: Set used or reconditioned K-5 front exhaust heads with valves, overhead, etc., for change-over from side exhaust. Harry B. Brown, Jellico, Tennessee.

WANTED: Wings and interplane struts in repairable condition for Fokker D-7. AERO DIGEST, Box 2501.

HAVE CASH FOR ghastly crate resembling World War type. Must be ferocious looking and flyable. Photographs if possible. Garni, Dunster A12, Harvard University, Cambridge, Mass.

HAVE $400 CASH for longwing Velie Monocoupe, Cavalier or OX Travel Air. Might pay more for Davis LeBlond. L. R. Anderson, Fulda, Minnesota.

WANTED: Set of lower wing panels for Travel Air 2000. Also inner plane struts. Write John Gray, 391 Selby Avenue, St. Paul, Minnesota.

K-5 OR K-1 EASTMAN aerial mapping camera wanted. State condition and kind of lens. AERO DIGEST, Box 2507.

WANTED: Curtiss Jr. or Flyabout, no cracks. State condition and terms. Fair fabric satisfactory. Ready to buy; write Pattisson, 422 E. 3rd St., Cincinnati, Ohio.

WANTED: Air tank and valves, and control for Heywood starter. Exhaust manifold, speed ring and cowling for Warner Scarab. Glen A. Baker, 811 N. Elm St., Muncie, Indiana.

WANTED: Waco F with B-5 or Warner or similar plane. Give full details first letter. J. Urban Goetz, 919 Fred St., Owensboro, Kentucky.

WANTED: Seaplane, amphib, or flying boat. Two- to eight-place. Give full particulars in first letter. AERO DIGEST, Box 2514.

WANTED: Licensed Rearwin Jr., Warner or Kinner Davis, or late Cub. Give complete information and lowest cash price first letter. Gene Linkert, 425 Grand Avenue, Dayton, Ohio.

WILL TRADE 80-acre Ozark farm, one mile modern town of 2500; ideal for summer home or income, for good ship, preferably cabin. Write 3921 Second St., Riverside, California.

WANTED: 1936 Stinson with controllable prop, radio, flares, landing lights, and blind flight instruments. Must be in first class condition. Will pay around $5,000 cash. C. J. McBride, Hotel Lafayette, 9th and University Place, New York, N. Y.

WANTED: Pontoons and/or struts for four-place Bird; also NACA cowling about 36 inches diameter and 20 x 4 wheel pants. Eaglet parts for sale. T. C. Chalk, 641 N.W. 77th St., Miami, Florida.

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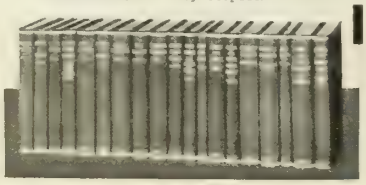
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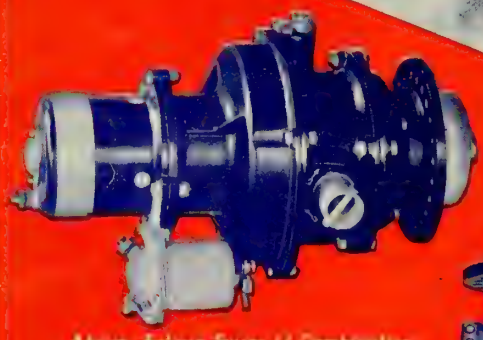


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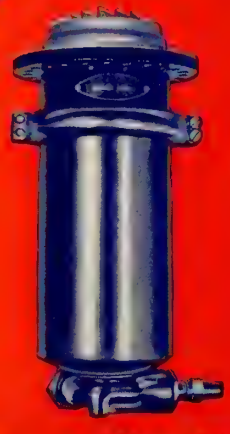
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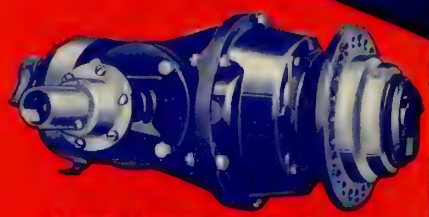
| POWER SOURCE | STARTER-TYPE |
|---|---|
| Manual . . . . . | (a) Inertia (Manual only)<br>(b) Hand Turning Gear |
| Electricity (DC-12 or 24 volt) . . . . | (a) Inertia (Combination Manual and Electric)<br>(b) Direct Cranking Electric |
| Air Pressure . . . . | (a) Air Injection |
| Cartridge (Powder) | (a) Combustion |
| Electricity (AC-110 volt—800 cycle) | (a) Inertia (Combination Manual and Electric)<br>(b) Direct Cranking Electric |

**ECLIPSE AVIATION CORPORATION**
EAST ORANGE, N. J.
*(Subsidiary of Bendix Aviation Corporation)*



*Above: Eclipse Series II Combination Hand and Electric Inertia Starter for 12 or 24 volt operation available with complete remote controlled acceleration and engaging means.*





*Above: Eclipse Type E-160 Direct Cranking Electric Starter with integral band cranking gear, for 12 or 24 volt operation and providing push button remote engine starting control.*

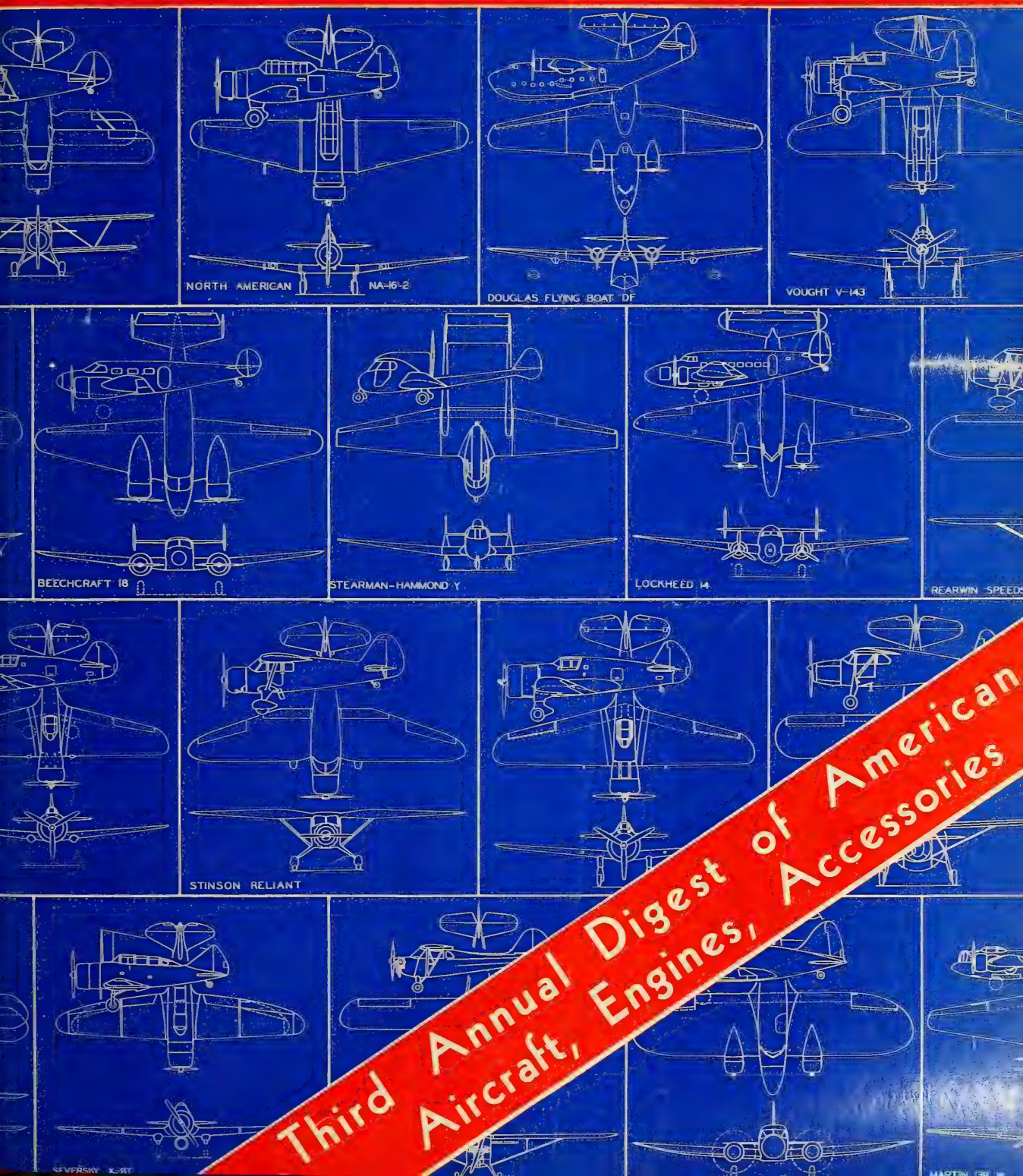
*Above: Eclipse Combustion Starter operating from power developed by remotely controlled igniting of concentrated energy in cartridge form.*

Visit the Eclipse Exhibit at the
**NATIONAL AIR SHOW**
New York Jan. 28 to Feb. 6
Booths 128 to 132

# AERO DIGEST

INCLUDING AVIATION ENGINEERING

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## Third Annual Digest of American Aircraft, Engines, Accessories

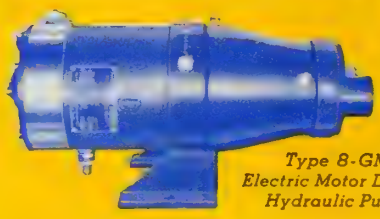
# Eclipse

# HYDRAULIC EQUIPMENT

THE Hydraulic equipment illustrated is representative of the types of units available to the aircraft manufacturer. An Engineering Department experienced in the design, development and manufacture of custom-built Hydraulic equipment is available to cooperate with those requiring assistance in the solution of their Hydraulic problems.

## ENGINE DRIVEN AND ELECTRIC MOTOR DRIVEN HYDRAULIC PUMPS

Eclipse Engine Driven or Electric Motor Driven Hydraulic Pumps available in various capacities to provide a reliable oil pressure source for the hydraulic control of Retractable Landing Gear, Wing Flaps and Retractable Wing Tips or Floats.



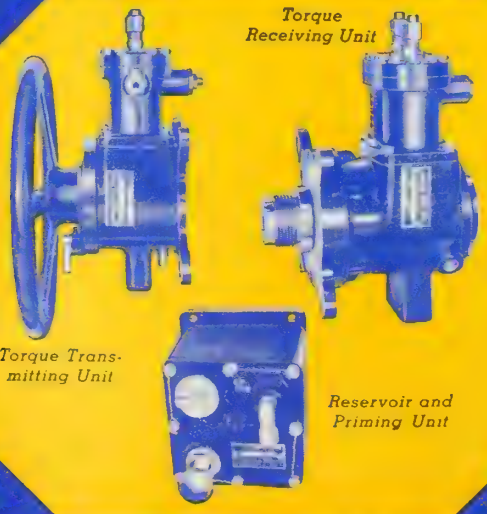
*Type 8-GM Electric Motor Driven Hydraulic Pump*



*Type 5-GS Engine Driven Hydraulic Pump*



*Type 5-GG Engine Driven Hydraulic Pump*



*Torque Receiving Unit*

*Torque Transmitting Unit*

*Reservoir and Priming Unit*

## HYDRAULIC REMOTE CONTROL UNITS

Eclipse Hydraulic Remote Control Units are custom built in accordance with manufacturer's specifications, wherein positive transmission of rotatable or lineal motion without the use of complicated mechanical linkage is desired. Provisions are incorporated in the system for maintaining constant pressure in the lines as well as automatic compensation for expansion and contraction of the fluid.

**ECLIPSE AVIATION CORPORATION**

*Subsidiary of Bendix Aviation Corporation*

**EAST ORANGE, NEW JERSEY**




*Published monthly by Aeronautical Digest Publishing Corp., at 515 Madison Ave., New York, N. Y. Yearly Subscriptions, $3. Entered as second class matter July 17, 1922, at the Post Office, New York, N. Y., under the Act of March 3, 1879. Additional entry at the Post Office, Philadelphia, Pa.*

# WATCH YOUR *first* STEP

## The Right First Step Always Gets Results

Curtiss-Wright training gave this Engineer "the start he required." Read his letter and his father's telegram.

Gentlemen:

I want to thank you for the excellent training I received while I was attending the Curtiss-Wright Technical Institute of Aeronautics.

As you know I graduated from the Engineering Department in November 1934 and by the end of January 1935 I was employed at The Heston Aircraft Co. Ltd., here in England. I have just been engaged at the Fairey Aviation Co. Ltd., in a better position.

I must say your training gave me the start I required and I have never felt incompetent in any way after I had once found my feet in the British aircraft industry—thanks to your efforts with a fine course and efficient staff.

Yours very truly,
H. RAY FOOTTIT.

Harlington, England.

WESTERN UNION

DELIGHTED ADVISE MY SON RAYMOND NOW EMPLOYED BY FAIREYS AIRCRAFT COMPANY IN ENGLAND STOP THIS FIRM ONE OF LARGEST IN GREAT BRITAIN EMPLOYING SOME TWO THOUSAND MEN STOP HEARTILY RECOMMEND YOUR INSTITUTE TO STUDENTS WHO ARE DEEPLY INTERESTED IN AIRCRAFT DESIGNING AND ENGINEERING AS A CAREER KIND PERSONAL REGARDS YOURSELF AND STAFF
HAROLD FOOTTIT

This mother confirms the success of another Curtiss-Wright graduate who specialized in Master Mechanics' training.

Dear Sirs:

I am writing to express my appreciation for the interest taken in my son, William, by you and your teachers while attending Curtiss-Wright School.

Your teachers are very efficient, experienced and understand the subjects that they teach, but more than that is the personal, helpful interest they take in each student which means so much.

You secured him a position in less than three weeks after his graduation, and he has been steadily employed ever since. He worked for Douglas Airplane factory for over a year, and has been at North American Aviation factory for a year.

He wished me to ask if you have a correspondence course in Engineering, which he might be working on and then finish at the school later.

Very truly yours,
(signed) MRS. ESTELLA KERNS.

Gentlemen:

I have now been steadily employed in the aircraft industry for over two years since graduating from Curtiss-Wright Tech, and in looking back over my training and two years of work in the industry, I thought you would be interested in knowing that I have steadily been more and more pleased with my choice of Curtiss-Wright Tech for my training. I have now been employed long enough to fully realize all the benefits I received at your School.

The personal interest shown and the splendid basic training I received has definitely proven to me that your training REALLY prepares a young man for a career in aviation. I have been able to handle all my assignments, since graduating, with ease.

I see lots of the boys I went to school with working in both the plants I have been, and I don't know of a single graduate who hasn't been thankful that he chose Curtiss-Wright training.

With best wishes for the continued success of Curtiss-Wright Tech, I remain, Sincerely yours,
(signed) WILLIAM K. KERNS.

# CURTISS-WRIGHT
## TECHNICAL INSTITUTE

**GRAND CENTRAL AIRPORT • GLENDALE, LOS ANGELES, CALIF.**
**MAJOR C. C. MOSELEY, President**



## The Journey of a Thousand Miles Begins with One Step

—OLD CHINESE PROVERB

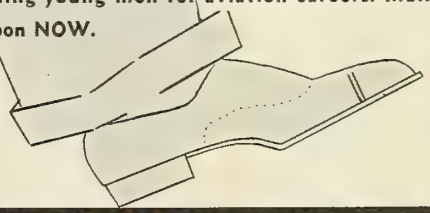
**Lao Tsze wrote this pointed proverb twenty-seven hundred years ago. Centuries have proven its value in starting a career.**

**Watch your first step, since it is the most important one of your entire journey through life.**

**Aviation executives, officials, and educators agree unanimously that *proper training is the first and most important step* a young man must take in aviation.**

**At Curtiss-Wright you are trained only in what the industry needs most—master mechanics—and aeronautical engineers. No flying is involved. The demand for Curtiss-Wright graduates constantly exceeds the supply. Graduates are securing immediate employment and are rapidly progressing to higher positions of responsibility and remuneration.**

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☐ HOME STUDY

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Date I plan to enroll_____ Age_____



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More than 150,000 passengers carried.

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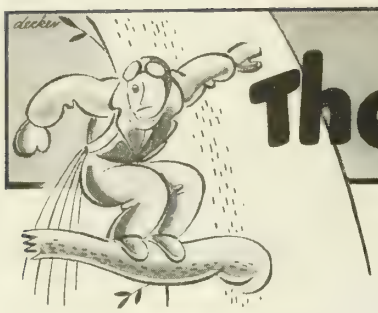
## NEW ELECTRIC TACHOMETER



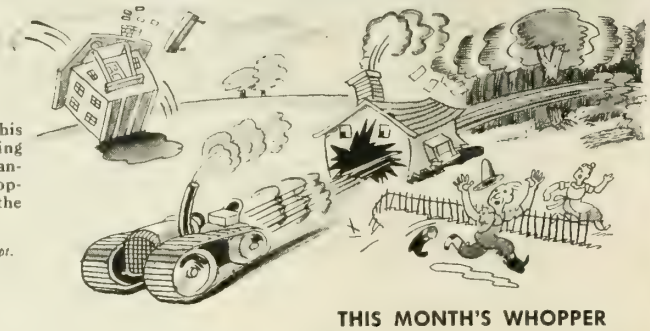

• Accuracy, guaranteed to 10 r.p.m., distinguishes the new Kollsman Electric Tachometers . . . Open uniform scale . . . One or two indicating pointers . . . Calibration is permanent and independent of the length of connecting wires . . . No brushes or moving contacts . . . All units completely interchangeable . . . Sealed-in life-long lubrication.

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**KOLLSMAN FOR PRECISION**



# The Birdmen's Perch



**In the last Perch we had a contribution from Australia. This month there's one from England. The old page is getting around. But, to keep it *on the git* we need a load of fresh scandal—more crazy happenings—and some plain elegant whoppers. Don't let us down. Shoot a line to the Editor of the Screwiest Page on Wings.**

MAJOR AL WILLIAMS, alias "Tattered Wing-Tips", *Mgr., Aviation Dept.*
Gulf Aviation Products, Gulf Building, Pittsburgh, Pa.

## BILL: £5 -15 -9½ d.

Here's a reply to "P. W.'s" story (see October Perch) about the pilot who nonchalantly landed a motorless plane:

"Doubtless, 'P. W's.' test pilot was quite accustomed to having engines fall out of planes, but over here in England it is a rare occurrence. So rare, that a friend of mine was considerably startled when one of his left him, especially as an 80 m.p.h. gale was blowing at the time.

"He found himself drifting backwards toward the aerodrome as the other motor wasn't enough to take him forward. It was no use trying to land downwind, so he put his plane down backwards, in a wheel landing, and dropped his tail after a short run. As his plane had a tail-skid, it didn't run much farther.




"Although the newspapers were full of the feat, the only souvenir my friend has is a bill from the owners of the aerodrome for £5—15—9½d., being the cost of repairing the aerodrome surface."

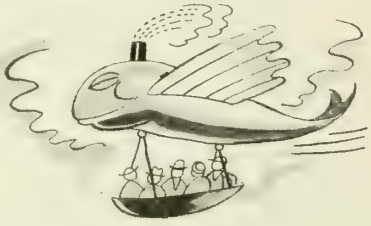
**—R. H. Ransford, The Grange, Priory Road, Felixtowe**

## CASTOR OIL: ITS FATE

"Is castor oil still used as a lubricant for aircraft?" writes a correspondent. The answer is, "No. A thousand times, No!"

The best oil, of course, for airplane motors is Gulfpride. This 100% Pure Pennsylvania oil is refined by the patented Alchlor process . . . a process so superior that when a mixture of six famous Pennsylvania oils (already refined) was subjected to it, 20% waste was removed from them.

## COMMERCIAL AIR LINE No. 1?



"The idea of commercial air travel is no spring chicken. It's at least 120 years old. Here's an article from a London newspaper of 1816 to prove it:

" 'Mr. Egg of the Strand (a German) has nearly completed a balloon in the shape of a dolphin, for the avowed purpose of carrying the nobility and gentry to Paris.

" 'It is to be made capable of conveying from 15 to 20 persons to Paris in 10 hours or less. It is worked by steam and the wings are intended to act as rudders.

" 'This scheme bids defiance to the usual exactions of inn-keepers, the customary search of custom-house officers, and all the ordinary impediments which so frequently annoy sensitive travellers.

" 'Mr. Egg is prosecuting the undertaking in a building at Brompton.' "

**—G. R.**

We wonder what happened to Mr. Egg. Do any of you birdmen know?

## FIRST FLIGHT CHALLENGED

"There are people up here in Bridgeport who swear that the celebrated Kitty Hawk flight wasn't really the first flight after all.



"They claim that a local night watchman, who later died unsung, made several flights along the streets of Bridgeport as early as 1900." **—W.T.**

## THIS MONTH'S WHOPPER

Gents:

I am being sued. Which it's all your fault

Here's how come. My cow is dying on account she argues the right-of-way with a rattlesnake. Now I hear that gasoline is good for snake bites, if you rub it on. So I starts to syphon some gas out of my plane, but the fool cow don't understand. She grabs the syphon hose in her face and swallers 10 gallons of that Gulf Aviation Gasoline afore I can stop her.

This here dying critter rips out a beller and goes high-tailing across the scenery, jumping fences, ditches and small barns. All afternoon she cavorts plumb fractious that-a-way, but that night she parts with 14 gallons of milk regardless.

But the milk ain't fitten to use, not noways. It smells like gasoline. So, just sort-of experimental-like, I pours 5 gallons of this here milk into the tank on my tractor. I gives the crank a twist and leaps for my life as the tractor roars past and disappears over the hill like excaping steam.



Well, that daggone tractor never stops until it runs out of milk, which is one hour later and 75 miles due west of here. And in between is a strip 6 feet wide and 75 miles long which is plumb ruined.

If you don't help me pay the damages, I'll bring my tractor down to your place and play ten pins with your refinery buildings. Yours Truly, **—H. R.**

P.S.—I'm still using the blame cow's milk in my tractor. Diluted, though—one part milk to 10 parts water.

**Gulf Oil Corporation and Gulf Refining Company . . . makers of**

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**GULF AVIATION PRODUCTS**




# —with PARKS AIR COLLEGE training

## Training for the Four Fields of Aviation

### The Professional Flight and Executive Course

This course provides foundation training for airline piloting. In it is secured 96 weeks of closely supervised flight instruction coordinated with an intensive ground school schedule in essential related subjects.

### The Aviation Operations and Executive Course

This course is offered those who see their opportunity in the operating field of air transport, other than piloting, and in the **business** of aviation. Dispatching, meteorology, traffic and field operations are some of the openings available to the graduate.

### Master Mechanics' Flight Course

The development of skills in *all* branches of aviation mechanics is given especial attention in this course. More than that, there is provided the broad basic training which develops the perspective necessary for advancement to supervisory positions.

### Aeronautical Engineering Course

A well balanced course that proceeds thru basic engineering subjects to extensive work in applied engineering courses, special attention being given to airplane design. Worthy of note is the liberal amount of time devoted to practical manipulative courses.

To those who possess the advantage of Parks training, aviation has given a new meaning to the excellent word "OPPORTUNITY".

For in aviation there are problems to be solved and problems are opportunities for those who can help solve them. As aviation grows, doubles and trebles in size, pyramiding to ever greater proportions, so are its problems . . . and therefore its opportunities . . . multiplied.

And Parks Graduates are taking advantage of these opportunities. You will find them in the organizations of practically every air transport and aircraft manufacturing company in America as well as in important individual enterprise. They are constructive factors in aviation. They are helping build this great new industry still greater.

Aviation executives recognize the ability of Parks graduates and value their services. They know that each one has secured a broad educational background, together with practical training, and so is well qualified to assist in the solution of problems in the division of aviation for which he has trained.

Often executives compete with one another for the services of the available Parks graduates. At times every member of a class is spoken for and placed in aviation before the date of graduation.

So, for the Parks trained man aviation lends a new, a positive meaning to the word "*Opportunity*" and this opportunity will be yours when you are being graduated by Parks Air College.

Because you are considering aviation as the field for your career and because you want to be assured of abundant opportunity in it, you are invited to send for the Parks catalog. It will give you complete information about Parks Air College including the outline of each course offered.

*Fill in the coupon, clip and mail NOW, before you turn the page. It will bring you your copy of the Parks catalog.*

Fully approved as a Transport, Ground and Flying School and Mechanics' School by the U. S. Dept. of Commerce.

Accredited by the Illinois Superintendent of Public Instruction.

*Visits of inspection are welcomed.*

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WORLD'S LARGEST COMMERCIAL AVIATION SCHOOL

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Please mail me, without charge, the Parks Air College catalog.

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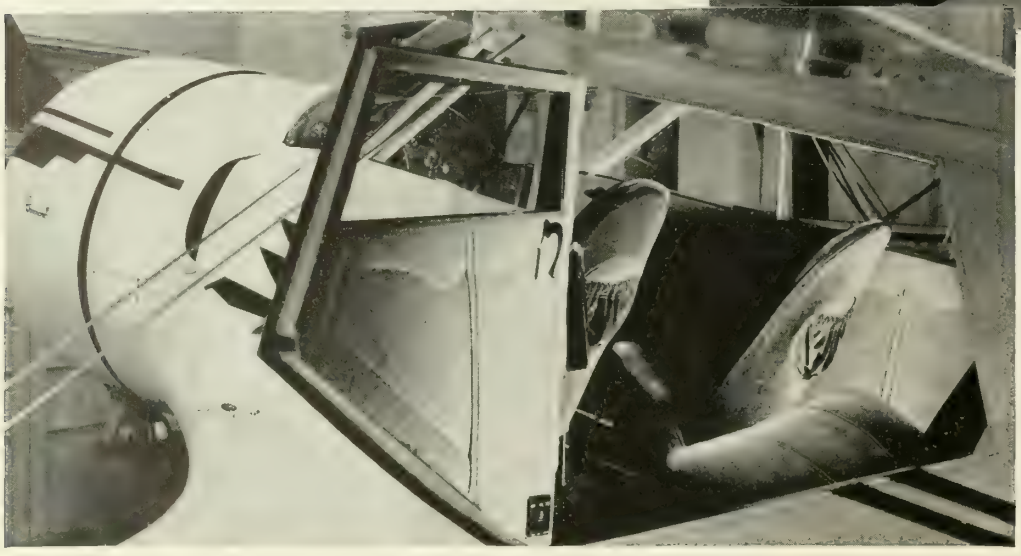
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Four major courses, each leading to the Bachelor of Science degree are offered:
- Professional Flight and Executive
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With all the new developments brought forth at the Show—Velmo Mohair Velvet continues as the one dependable transportation fabric!

Its success in previous Beechcraft (and other) planes... its decades of satisfaction in railroading and automobiles... makes it the air liners' logical upholstery.

This rich mohair velvet is definitely *sound-absorbing.* It blankets noise as no hard-surfaced fabric can. It gives passengers luxurious *comfort,* and gives the seats unlimited flying hours of *wear.*

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# Owner Finds *the New Cub* the Perfect Airplane for Business and Pleasure

ANYTHING you can use for both business and pleasure has a double value. And anything that makes business a pleasure in itself, is worth many times its cost. That's why more than a thousand Cub owners are so enthusiastic about their planes—and why Mr. W. J. Beaulac of Shawinigan Falls, Quebec, writes so proudly of his Cub:

"In two months I have flown my Cub 210 hours, carried 596 pay passengers and made a profit of $867.50.

"The enclosed photograph was taken on a recent hunting trip. We landed on the beach of Lake St. Petter, near Nicolet, and the ducks were killed about 500 feet from there. The next morning we put all these ducks in the luggage compartment of the Cub. With our rifles, my friend and myself, it was quite a big load but the Cub made it easily.

"My Cub is as good and nice-looking as new and as soon as I get time, I shall fly to Bradford to show you how proud I am of it."

**SEE THE BIG EXHIBIT OF CUBS AT THE PACIFIC AIRCRAFT AND BOAT SHOW**

*The New Silver*

**CUB**

**World's Fastest Selling Airplane**




Whether you fly for business or for pleasure—a new Silver Cub will give you the greatest sport you ever had! With absolute safety, unequalled simplicity of operation, almost unbelievable economy (using less than 3 gallons of gas per hour and practically no oil) and costing only $1270 F.A.F. Bradford, Pa.—the new Silver Cub is aviation's biggest value!

But don't delay—daily mounting labor and material costs make this new low price subject to change without notice. You need pay only $425 down and the balance in easy monthly instalments. So buy now—and save!

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***We have what we advertise***

and more. That is our plan of doing business. No overstatements. No misrepresentations. No "ballyhoo". Right to the point in all things and no excuses.

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Our prices are fixed on an operations cost basis, therefore, much lower than elsewhere. Our all-year operations give us a decided advantage as we have no layoff or off-seasons. No loss of time for the school or its students.

## 6,600 AIR HOURS IN 1936

Which goes to show that our students "get the job done" and get it in less time than at any other school. You save time, money and living expense with any of our courses and get more for your money. That is a fact.

## NATIONAL and INTERNATIONAL

Our students come from all over the U. S. and many foreign countries. This school is approved by the Government Immigration Department for the entrance of foreign students into the U. S. on a student basis. See the U. S. Consul in your country for details if you are interested.

## OUR BIG INVESTMENT

includes 14 buildings for school operations. Hangars, shops, cafe, dormitories, ships, machinery, tools and parts department. All students live at the school. Every city convenience. A complete School. All training at Love Field, one of the Nation's finest airports. Adds much to your training but nothing to the cost.

***14 GOOD SHIPS***

5 Fleets, Waco Cabin, Bellanca, 6 place cabin.
Tri-motored all metal Ford, 14 place.
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The Nation's finest array of school aircraft.

## YOU CAN'T BUY MORE, WHY PAY MORE?

Every course we offer exceeds Government requirements and you can not miss here. The school is operated by its owners and a complete staff of instructors and employees.

## FLYING COURSES

Our MASTER AIRMAN'S COURSE covers a period of one year, 310 air hours, and it is the most complete airman's course in the U. S. Our TRANSPORT PILOT'S COURSE covers six months training, 210 air hours, and compares favorably with similar courses offered elsewhere requiring one year to complete. We get the job done.

## MECHANICAL COURSES

Our Advanced Aviation and Mechanics Course requires 44 weeks to complete. Expert training at all times. Equal of the average two year course. The Master Mechanics Course covers a period of six months and is the best foundation course in the country.

## 1937 CATALOG and PRICE LIST

**DALLAS AVIATION SCHOOL,**
**DALLAS, TEXAS.**

Please send your 1937 "Eyes of Texas" Catalog and price list. I expect to take a course in aviation soon and am interested in

**FLYING** ☐ **MECHANICS** ☐

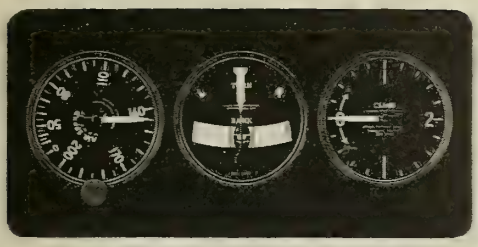
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Town..... State .....

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Based on sound engineering and supported by thorough research, design, and exacting workmanship—every Pioneer instrument is a symbol of manufacturing skill. It is our aim to anticipate the future trend of Aviation.

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*The 5-place Whirlwind "45"*

The Fairchild "45" was designed for the man who wants the best in personal air transportation. Every detail of engineering, of structure, of design, and of finish reflects superlative quality. Its flowing lines are kin to the most modern airliners—aerodynamically clean, efficient and beautiful.

Exteriors and interiors for 1937 are custom-designed by Raymond Loewy, outstanding American stylist. Color combinations — inside and out — the choicest of fabrics, appointments and decorative trim have been blended into perfect symphonies of this expert stylist's art.

But the "45" is more than a thing of beauty. It is exhilarating transportation. Its performance is stimulating, spirited—with truly remarkable ease of handling.

## *Completely Equipped*

Wright R-760 E-2—320 H.P.
Controllable Pitch Propeller
Engine-driven Generator
Powerful Split-balanced Flaps
Rudder and Elevator Tabs
Adjustable Seats and Pedals
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Glove Compartment, Ash Trays
Exceptional Baggage Space
Provisions for Radio Accessories
Complete Shielding and Bonding
Heater and Ventilators
Safety Glass Throughout

Cross-continent trips almost duplicate airline schedules. Small fields can be negotiated with ample reserve—both in and out. Its instrument arrangement permits proper placement of everything desired for day or night flying—good weather or bad. Its interior dimensions —seat width, cushion depth, elbow room, head room, floor space—combine to furnish relaxful comfort and absolute ease.

The Fairchild "45" owner enjoys distinction and pride. He also enjoys the peace-of-mind which comes from the knowledge that this airplane is unequalled in its class for excellence of materials and workmanship . . . a personal plane built to the highest known standards of precision — to Fairchild standards!

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## *The Deluxe Warner "24"*

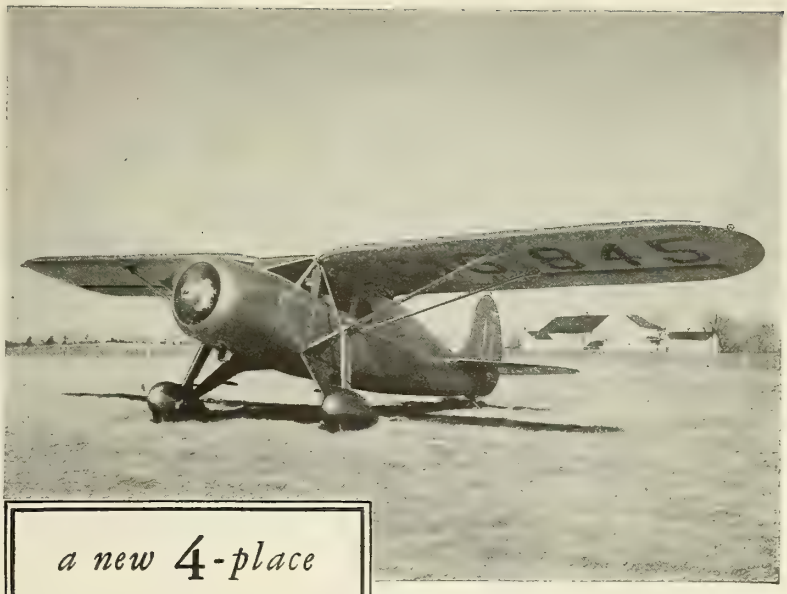
The Warner "24" has begun its fourth year of continuous production, constant refinement and definite leadership in popularity among owners who do their own flying.

Fairchild's many years of manufacturing experience has brought the "24" into the spotlight of international prominence—for quality, for reliability and for perfect aerodynamic characteristics.

The 1937 model "24" is a plane with every single feature tried and proven, through testing, engineering knowledge, and many thousands of hours flown on its hundreds of predecessors. It is a plane built for lasting satisfaction—the finest possible value in smart, medium cost air transportation.

To the 1937 De Luxe Warner "24" have been added such new refinements as retractable ventilators, optional three or four passenger seating arrangement, crank-type window control, revised, Lord-rubber-shock-mounted instrument panel, asbestos insulated sandwich-type firewall, map pocket, Fairchild transport-type instrument illuminator and Raymond Loewy styling.

The De Luxe "24" is an innovation in aircraft beauty. With the graceful contours of exterior design harmonizing with interiors of richness, color and texture, this 1937 model combines utmost dependability, perfect control, economy of operation and maintenance with a style and distinction never before obtainable in any airplane.

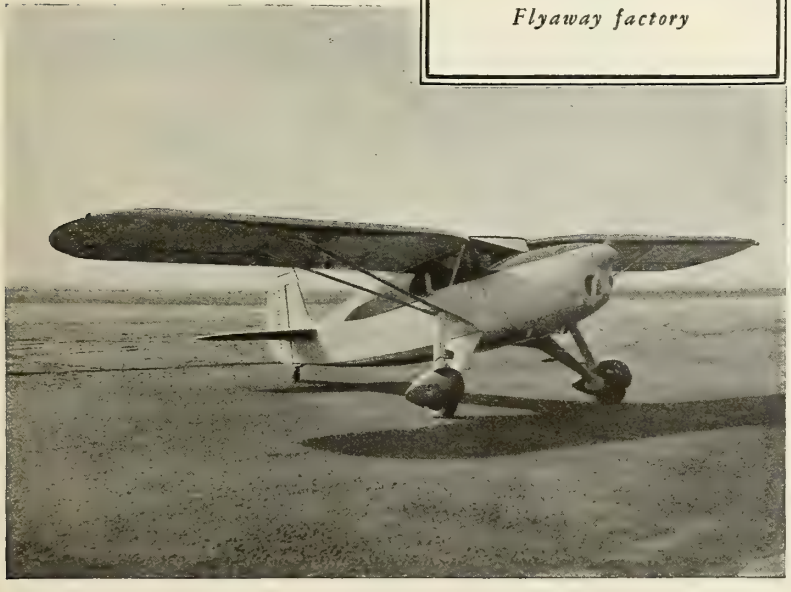


## *a new 4-place Warner "24"*

Standard model, with a lustrous exterior finish in polychromatic colors incorporates traditional Fairchild quality and flight characteristics. Contrary to a general price increase in 1937 airplanes, Fairchild offers this popular model as a four-place ship at the reduced price of

**$5290.00**

*Flyaway factory*



Featuring the Fairchild-built Ranger engine, this model is particularly appealing because of care-free operation, extreme smoothness and perfect reliability.

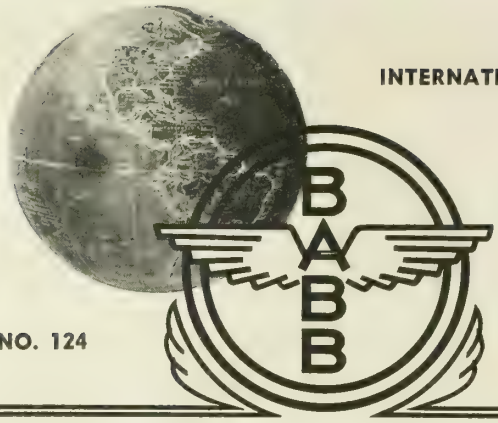
The Ranger engine—a six-in-line, developing 150 horse-power—incorporates an oil-lubricated valve mechanism which requires no maintenance or service for 400 hour periods. In performance the Ranger "24's" two-mile-per minute cruising speed at a cost of less than 2½ cents per mile for fuel and oil, combines with quick take-off and slow landing to spell economy, assurance, safety and satisfaction to its owner.

In addition to the De Luxe refinements featured in the Warner "24", a cabin control has been added to the oil radiator. The Raymond Loewy styling is particularly effective on this sleek, racy design. Such Fairchild "24" features as complete ball-bearing controls, split-balanced flaps, wheel streamlines, safety-glass windshield, glove compartment, assist cords, ash-tray, dual chrome-plated control sticks, two doors, adjustable pilot seat, hand-rubbed fuselage, engine-driven generator with automatic control and booster coil are standard equipment.

For complete and detailed information see your nearest Fairchild distributor or dealer—or, write directly to the factory. Demonstrations will be arranged at your convenience.

## *The Deluxe Ranger "24"*

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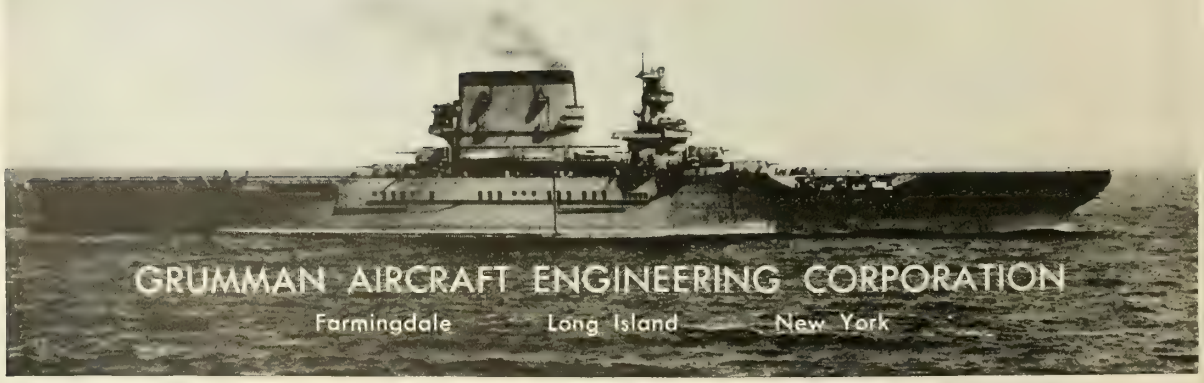
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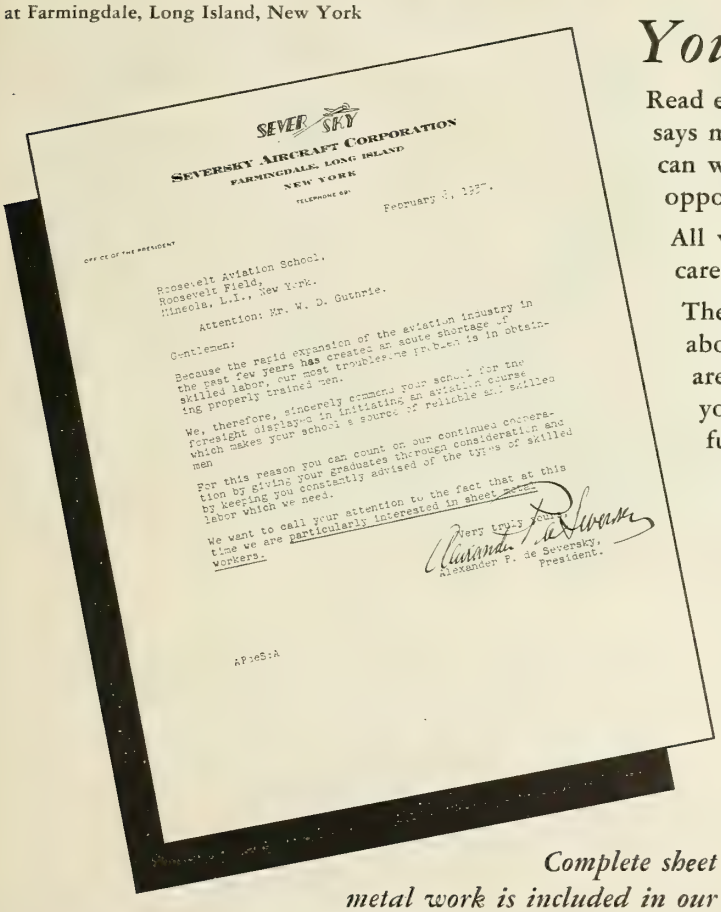
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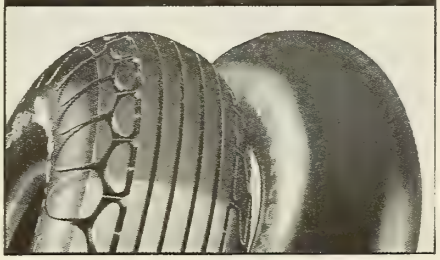
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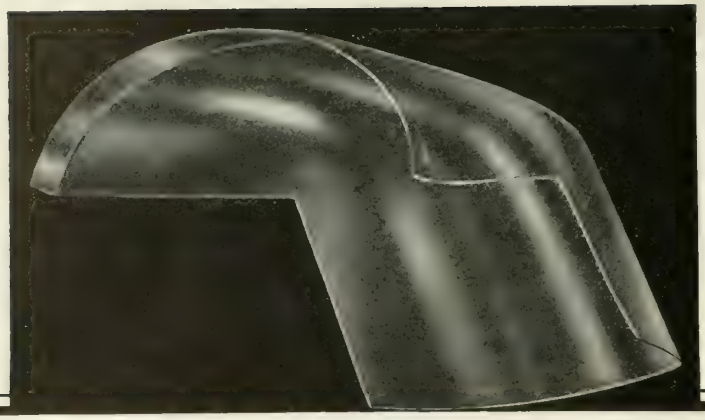
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# LOOKING AHEAD

CY CALDWELL



● A glance at the extensive array of airplanes and engines listed in this issue of AERO DIGEST (the magazine of the air—both hot and cold) will serve as a reminder that Michel Detroyat of France paid the U. S. a hurried visit last summer. He's the fellow who streaked off with practically all our cash speed prizes at Los Angeles in a 3-year-old Caudron racer powered with only 340 horses emerging from a little six-cylinder air-cooled Reanult engine. Mons. Detroyat—or Detroit, as we illiterates call him—assured me that he is coming back to this so delightful, so *bon* Etats Unis next summer with a modern Caudron. The one with which he beat the pants off us, he remarked, is obsolete, and he would hesitate again to affront us moderns with a craft of such ancient vintage! He told me also that, suspecting that the American pilots in the Thompson Trophy Race must have been flying throttled back as a courtesy to a visiting pilot whom they wanted to see win, with true French politeness he also throttled back so to keep not too far ahead of them. I thanked him profusely in my best war-time French for thus showing us consideration, and assured him that our pilots hope he will win again next year, as a mark of their appreciation of what Lafayette did for us some time ago.

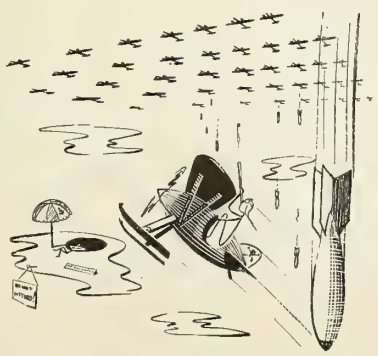
In recent years air racing seems to have become divorced, in the average mind, from any vital connection with useful commercial and military aviation—despite the fact that the older Curtiss Pursuits were direct descendants, engine and all, of the Curtiss Racers. The latest English Interceptors (probably now the world's best) also are descendants of those same old Curtiss Racers—(engine and all) for the vaunted Rolls-Royce of the Eagle series had one of the most God-awful valve mechanisms the mind of man ever conceived—until the Rolls people saw the Curtiss D12 and adopted its valve mechanism, designed by an ingenious chap named Charlie Kirkham.

Now just as the English learned from us, so may we learn from the English and other foreigners. In engine development we have confined our endeavors largely to the air-cooled radial, practically ignoring the large liquid-cooled engines which make high speeds possible. There's nothing as useless as a second-best pursuit ship: if you have no ship at all, you stay down and are safe; but if you have a second-rate one, you go up and probably get shot down. We haven't a pursuit ship today that could overhaul an Italian Fiat bomber powered with Fiat engines of over 1000 hp. And we have no engine to compare to the Fiat AS.6 of 24 cylinders (in two units of 12 each) which has held the world's absolute speed record since April, 1933.

In the last few years we've been letting the Henderson Brothers dig up what little money has been spent on racing airplanes and engines—and that is only a portion of the gate receipts at air races. Who reasonably expects this country to beat England, Italy, and France in air racing when all we give our racing pilots, designers, and manufacturers is peanut money? It isn't only to break records and win prizes; it is to further the advancement of commercial and military aviation that racing should be considered a vital laboratory part of the aviation industry. In America today it's just a side show, like the nuts who race motorcycles on the inside of a 30-foot cylinder.

**Money For Development**

My friend, Bill Nye of San Francisco, the aviation expert and New Deal Democrat whose friendship has survived even the election, suggests that the Aeronautical Chamber of Commerce should sponsor a contest with *adequate* prize money to advance the development of airplanes and engines that at least should get us out of the Junior Birdman class of international air racing—get us so we have a chance of catching up to and passing Sportsman Detroyat, who would then be able to give us a further lesson in the realm of good sportsmanship—which, judging by some of the grousing I have heard, we need. This contest should be in the nature of an aid to our present commercial racing program, limiting horsepower and size of ship, so we do not wipe out, financially, 90% of our present racing builders and pilots.



*What chance has a "second best" pursuit?*

In addition to that industry program, however, the United States government should give sufficient money to the Army Air Corps or to the Navy, or both, to enable them to develop a real racing plane and engine—one considered purely as a speed laboratory product which will influence further military and naval plane and engine design. This ship, or these ships, should be built for speed records only, and not to take race prize money away from hard-working—and hard-pressed—commercial pilots, many of them already down to hot dogs. While you can't defend a country with speed records, enough may be learned while going after those records to improve materially the design of military airplanes and engines. We spend millions resettling people who were born unsettled and will so remain, no matter what is done for them. We might spend a few millions resettling some international speed records. The English, French, Italians and even the Germans laugh at us when they think of large liquid-cooled engines; we are simply not in the picture, except perhaps with one toe, which we are dipping in the liquid sort of experimentally.

The U. S. leads the world in commercial transport planes and engines, also in planes for the private owner. We are a peaceful people, and our aviation program proves it. But we don't happen to be in a peaceful world, and strangely enough, there are really people who don't like us. In fact—and this distresses me—nobody likes us but Finland. All the rest owe us money—and you know how you feel about your creditors; you hate the wretched fellows and wish they would slip on an empty banana. Now the banana skin on which more than one nation is going to slip during the next two decades is called Air Power. We have a pair of nice wide oceans, one on each side of us, and a couple of peaceful neighbors, so we may struggle along with a second-best air force. But I feel slighted when our government provides not a *second-*

(*Continued on page* 30)

# Review of the Annual Meeting of th

**The Fifth Annual Meeting of the Institute of the Aeronautical Sciences attracted an even greater gathering than in previous years. The assembled constructors and engineers certainly could not complain of the lack of scientific material placed before them. In fact, during the three-day meeting, with 54 papers on the program, some of a highly mathematical character, the visitors complained of some degree of mental indigestion. In this brief presentation the writer covers Aerodynamics, Structures, Engines and Fuels, and Meteorology**

DR. ALEXANDER KLEMIN

### General Aerodynamics

● At the session on General Aerodynamics, the two first papers *Approximate Span Load Distribution for Preliminary Design* by Henry A. Pearson, and *Computation of Lift Distribution Over the Span* by Dr. Max M. Munk, confirm the interest in this topic. Our readers, perhaps already know that the ANC Conference (Army-Navy-Commerce) has issued a bulletin on span load distribution calculations which is likely to become the standard method. While the basic theory of the subject has been understood for several years, the adoption of more refined methods of distributing loads along the span are symptomatic of the advanced methods of modern structural analysis.

Arnold M. Kuethe (Daniel Guggenheim Airship Institute) described an interesting piece of apparatus for gust research, *Airflow Studies in the Institute's Gust Tunnel.* A whirling arm moves the model to be investigated in a circular channel at 170 mph. A vertical tunnel with its flow at right angles to the circular channel supplies the equivalent of a vertical gust as indicated in figure 1. Varying the speed of the whirling arm or changing the speed of the flow in the vertical tunnel offers the investigator the ability to submit the model to gusts of varying intensity and varying rates of growth. In a related paper Dr. Th. Troller gave the results of *Investigations on Airships in Gusts.* As previously suspected the effects of gusts on airship fins is much more powerful than indicated by static tests in the wind tunnel and ordinary calculations. Constructors agree that this method of gust research, developed primarily for the airship, might well serve in airplane work. As is well-known stress analysis computations for an ATC are based on an instantaneous gust velocity of 30 ft./sec. V-G charts figure

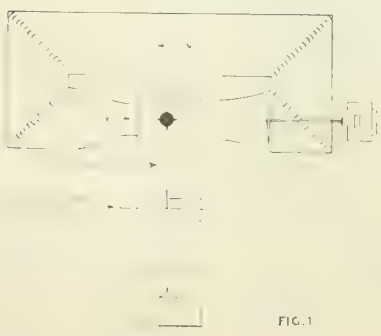


FIG. 1

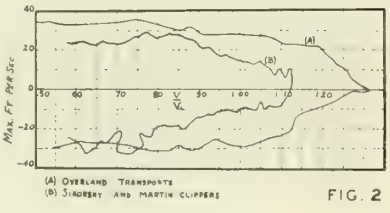



FIG. 2

2 presented at the recent Detroit meeting of the SAE by Mr. Rhode indicate that this method is reasonable. (Figure 2 shows effective gust velocities from V-G records.) There is some suspicion, however, that the method may be unduly conservative for lightly loaded airplanes and not conservative enough for fast heavily loaded machines. Research on the whirling arm might include a study of the effects of gusts of different gradients on airplane models and help clarify the situation.

R. P. Harrington, in his paper *Autorotation of a Slotted Wing,* presented results of autorotation studies illustrated roughly by figure 3. Autorotation tests were made with a normal wing in which (a) all slots were closed; (b) inboard slots between sections AA-BB were open; and (c) slots were open along the entire span.

Results of the tests indicated that: (1) slots decreased the rate of autorotation and the angle of attack range within which autorotation may be expected; (2) maximum lift was not much affected by the slots; and (3) minimum drag was increased 18% by full span slots.

These tests are of some scientific interest but it is difficult to see their practical utility.

### Structures: A Plea for Stainless Steel

While aircraft construction in stainless steel dates back some 10 to 12 years, it is surprising that this material has not been more widely adopted. Perhaps this is due to the fact that the early tendency was merely to substitute stainless steel for aluminum alloy. The structure of an airplane should really be designed for stainless steel to be entirely satisfactory —a point of view forcibly expressed by W. L. Sutton in his paper *Stainless Steel Aircraft.* It is not possible to rework or duplicate an aluminum alloy airplane without heavily penalizing the use of stainless. Stainless steel must be used in as compact a form as possible and should be so positioned as to be highly stressed. This may be accomplished in the basic design by the selection of a monospar type of wing. (Figure 4) This type of wing, with metal from the leading edge to the 30% point of the chord and fabric aft of this point, lends itself particularly well to stainless steel, since in such construction the entire load is carried on the first 30% of the wing. With a load factor of 6g and a wing loading of 25 lbs./sq. ft., the gross load on the structural portion of the wing is then approximately 500 lbs./sq. ft. With this load it becomes possible to utilize high tensile strength steel of sufficient thickness to avoid any local instability or elastic failure. It is true that even with monospar construction, aluminum alloy would require fewer stringers to support the thicker skin. Yet, preliminary design, as Mr. Sutton stated, indicated that a stainless steel wing of the above type can be built for approximately the same weight and cost as one built of 24S-T.

Granted equality in these two important factors, what is then the main argument in favor of stainless steel? First, the important element of fatigue limit. 18-8 stainless steel has a fatigue limit which is approximately 50% of its ultimate ten-

(*Continued on page 27*)



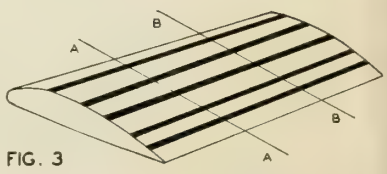



FIG. 3

# nstitute of Aeronautical Sciences

**As on previous occasions the Annual Meeting of the Institute of the Aeronautical Sciences (Jan. 27, 28 and 29) took place at Pupin Physics Laboratories of Columbia University. The papers read touched upon practically every subject of importance in Aeronautics. In a brief resume the writer can give only the theses of various papers and indicate some of the conclusions and avenues of approach. Papers on the following are reviewed: Fluid Mechanics, Long-range Seaplane and Airship Problems, and performances of Airplanes**

DR. MICHAEL WATTER

### Fluid Mechanics

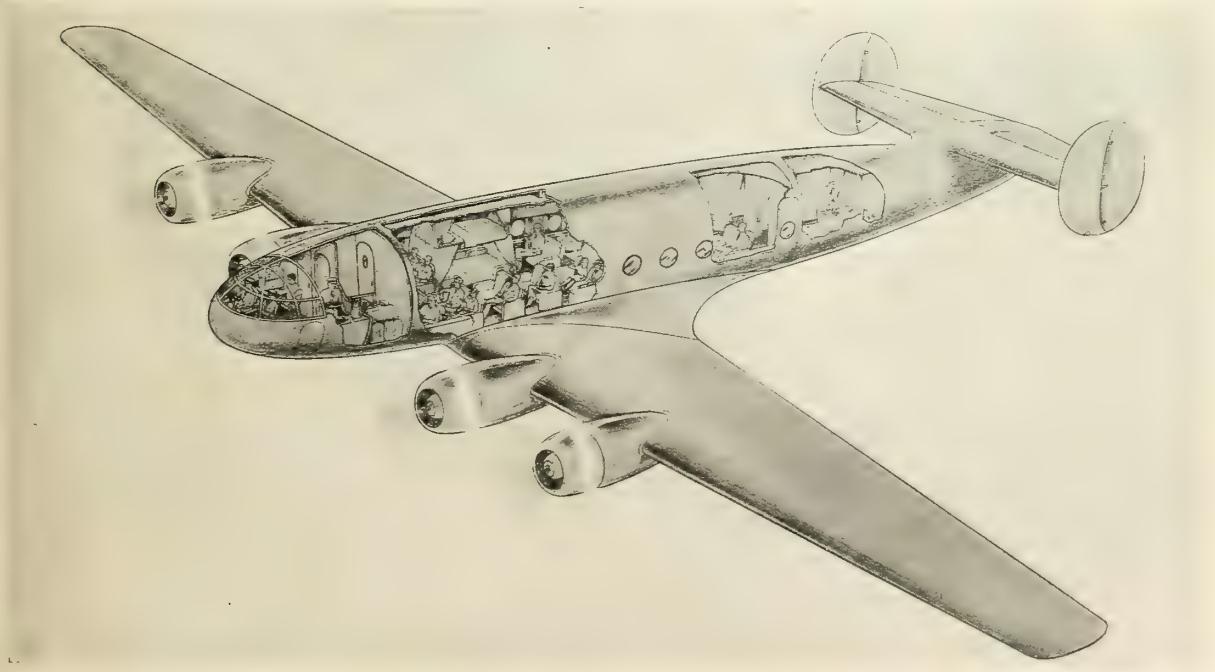
● The first three papers presented on fluid mechanics were of broad scientific scope; two treated the subject of turbulence, and the other being concerned with the theory of flow of compressible fluids. Th. von Karman's (Calif. Inst. of Tech.) paper on *Fundamentals of the Statistical Theory of Turbulence*, presented for the author by Clark B. Millikan, marks an important step towards rational treatment of the complex problem of turbulence. This paper represents an extension of Karman's former work and its general solution includes previously suggested logarithmic law. It indicates also that Taylor's solution is but a special case of the general law.

Dryden's (Bureau of Standards) paper *Theory of Isotropic Turbulence* deals with the same subject as Karman's but approaches it from a different point of view. Instead of treating the subject of the state of flow, it deals with transport of energy; while the first paper treats the turbulent field with close analogy to an elastic field the second treats it analogously to an optical field. Th. Theodorsen (NACA) spoke on *Compressibility Effects*. It appears that he is attacking the problem at its foundation, and rather than attempt plausible interpretations of the compressibility effects observed in experiments, the paper was directed toward the establishment of mathematical relationships of the flow of compressible fluids. Theodorsen pointed out that the introduction of compressibility does not change the general equations of flow beyond the necessity of treating density as a variable. An interesting observation made by the author was that theoretically, (similar to the case of ideal incompressible fluids) a body in a current of compressible fluid should have no resistance.

J. D. Akerman (Univ. of Minn.) in a paper on *Visualization of Airflow by Means of Concentrated Beams of Light* outlined a method first proposed by Prof. Pawlowski of the Univ. of Mich. It consists in introducing in the airstream, fine aluminum dust and throwing an intense plane of light where the experimenter wants to observe the nature of the flow. Thus the plane of light is also the plane of exploration, the pattern being visible as ordinary dust is visible along a beam of sunlight. To prevent shadows there are sources of light on two sides.

W. Bollay (Calif. Inst. of Tech. presented *A Theory of Wings of Very Small Aspect Ratio*. Making use of the vortex theory and introducing certain simplifying assumptions, Bollay solves the case of an aspect ratio of zero (finite span and infinite chord). The solution for the normal force is nothing but the well-known Newtonian Sin square law. The author indicated that this law holds up to an aspect ratio of about .6, but beyond that the observed results begin to depart and approach closer the value given by the Munk-Prandtl theory.

J. Atsumi's (Calif. Inst. of Tech.) paper *Pressure Distribution on a Wing*



*Martin "Streamliner," Glenn L. Martin Co.'s typical supercharged high altitude transport described by Mr. McDonnell*

*with Circular Planform* was presented by W. C. Rockefeller. It was observed that the spanwise lift distribution is substantially rectangular at small angles of attack, departing from it with increase in angle of attack. At the center, loads remain proportional to the angle but at the tips, the increase is much more rapid and is accompanied with a backward shift of the center of pressure. This characteristic may shed light on the apparent difference in behavior of flaps on surfaces of normal and small aspect ratios.

#### Long Range Seaplane and Airship Problems

Commander C. E. Rosendahl's (Naval Air Station, Lakehurst) theme was *Oceanic Airship Service.* A splendid talk by an enthusiastic believer in lighter-than-air craft, it was a plea and an accusation —a plea for the dirigible and an accusation of heavier-than-air. Fortunately, the audience consisted of engineers, since to the uninitiated the case of the large airplane was a sad plight during the time that Comdr. Rosendahl lashed the airplane and extoled the dirigible.

B. C. Boulton (Glenn L. Martin Co.) delivered an important paper on *Aerodynamic Factors in the Design of Long-Range Flying Boats.* With the actual operation of air passenger transport over the Pacific and an imminent beginning of this service over the Atlantic, the problem of range, payload and cruising speed is of vital importance in connection with the design of long-range craft. Introducing new factors and a generalized expression for the airplane polar, the paper arrives at basic relationships of various factors entering into the problem of range. In bringing out clearly the importance of span, it points to a definite trend in long-range design. Another important factor stressed by the paper was the fact that with but little sacrifice in range, cruising speeds can be proportionally much higher than the theoretical optimum speed.

Rex B. Beisel (Chance Vought Corp.) delivered a paper on *Why Use Cowl Flaps,* stressing the importance of this type of controlled gill opening. Since for proper cooling the drop in pressure required remains practically constant, it is obvious that for high speed conditions of flight, the gill opening may be reduced considerably. For full power climb and cruising speed it is necessary to modify the cowl to obtain the required drop in pressure and the author pointed out that the use of the flap provided better cooling for a given gill opening than that possible with the same opening with flaps.

J. S. McDonnell discussed *High Altitude Airplane Compartments* describing briefly a few of the experiments conducted by the Glenn L. Martin Co. in connection with high altitude development work. A number of interesting facts brought out by the paper indicate that "Nature has facilitated man's path to higher altitude flying." McDonnell's conclusions are that: (1) sudden decrease in pressure (which may be caused by punctured pressure compartments) will not be injurious to personnel; (2) after a sudden decrease in pressure, anoxemia does not become dangerous instantaneously, thus allowing time for a descent to a lower altitude or for a supply of extra oxygen; (3) the shapes best suited structurally for supercharging are also best suited for streamlining; and (4) heating of supercharged cabins is aided by the fact that (a) the centrifugal blower required for pressure heats the air and (b) since human beings can comfortably accept higher than normal carbon dioxide content only small amounts of cabin air must be regularly discharged.

#### Airplane Stability and Performance

C. H. Zimmerman (NACA) spoke on *The Present Status of Stability Research.* The paper proposed a consideration of "inherent stability" and "course stability." The objectives of the first are: absence of divergence, long period of oscillations and rapid damping; in the second, it is desirable to have rapid return after disturbance, no oscillation and smallest deviations.

In analysing the present status of available data, the author clearly and forcefully indicates our limited knowledge of those factors obtainable by more than simple "static" tests equivalent to unaccelerated rectilinear motion. Our knowledge of induced effects while in more complex forms of motion are limited and it is here that the application of mathematical theory of stability meets its greatest handicap.

Dr. Alexander Klemin (N. Y. Univ.) presented a paper on *Design Application of Longitudinal Dynamic Stability Theory.* From the consideration that stability requirements must be coordinated on the basis of pilots' and occupants' response, Dr. Klemin expressed the desirability for limited static stability, short oscillations, heavy damping and a limit for period of not more than 40 secs. nor less than 10 secs. with 4 oscillations to damp to an amplitude of which the passengers may be conscious. For preliminary engineering calculation of dynamic stability two new stability constants were proposed: one for the expression of the slope of the moment curve and another for the expression of the damping derivative.

W. C. Rockefeller (Calif. Inst. of Tech.) described *An Airplane Performance Slide-Rule* developed by him. Since in most of the parameters entering into the problem of performance calculations the operations required do not involve additions or substractions, it is obvious that the principle of slide-rule may be used as a substitute for graphs and alignment charts. The slide-rule proposed makes use of W. Bailey Oswald's method for determination of the horsepower required. The determination of the horsepower available has not been included in the proposed slide-rule.

R. K. Mueller (Glenn L. Martin Co.) presented a method for *Graphical Solution of Stability Problems.* Having pointed out that any expression containing trigonometric functions is susceptible of a ready graphical representation by means of circles, Mueller illustrated the application of the method by two examples. He stated that the method was applicable to solutions of various vibration problems as well and that its greatest value was in showing clearly the mutual effects of different factors and their variations.

The problem of tabs was treated by C. J. Wenzinger (NACA) in his paper on *Notes on Tabs.* He presented Dr. Lachmann's method for graphical representation and analysis of tab data and focused attention once more on the general confusion of terminology in connection with various possible tab designs. NACA nomenclature presented covers all combinations in use so far.

#### Flying Properties and Flight Tests

Of the 4 papers presented during this session, one dealt with flying properties criteria, 2 with flight testing and one with experimental model research in connection with power-on stability.

E. P. Warner's paper *Putting Flying Properties on a Quantitative Basis* was read by E. T. Allen (Pan Am.-Grace), the chairman of the session. With increase in the size of aircraft and its establishment as a passenger carrier, the problem of flying properties must of necessity be placed on a strictly quantitative basis. It is not sufficient to rely purely on test pilot's opinion: it is important to establish certain measurable standards and provide the equipment with which to measure them. Warner's paper is an outcome of many conferences which included airline and NACA personnel It is an important step in the right direction although there is bound to be evolution in criteria proposed. The paper touches upon the factor of stability and control, stressing the fact that different types of craft require different standards.

M. N. Gouch (NACA) spoke on *The Use of the Trim-Angle Indicator for Seaplane Take-Off.* The instrument proposed is a periscopic device which shows the image of the horizon in reference to a set of divisions indicating the attitude of the boat reference line (keel line forward of the main step). There are many reasons why the addition of this supplementary "gadget" must be welcomed. The take-off of heavily loaded flying

(*Concluded on page* 159)

## DR. KLEMIN'S REPORT

(*Continued from page* 24)

sile strength, whereas the fatigue limit of 24S-T is only 24% of its ultimate strength. Again, the melting point of 18-8 stainless steel is approximately 2200° F., which is an important fire hazard consideration, particularly when fuel tanks are within the wing. Still another advantage lies in the fact that a rivet in aluminum alloy usually projects a few thousandths of an inch, while shot welding of stainless leaves a smooth surface, which is vitally important in high speed aircraft.

Mr. Sutton also made a strong plea for the use of stainless steel in hull bottoms. Hull bottoms are designed as diaphragms for high unit pressure with the stipulation that no permanent set takes place under the application of the uniform applied loading. Stainless has a yield point of 150,000 lbs./sq. in., while 24S-T has a yield point of 40,000 lbs./sq. in. Multiplying the 40,000/sq. in. by the weight ratio of 2.84 of the two materials, the comparable yield point of aluminum is only 114,000 lbs./sq. in. Permanent set is dependent entirely on the yield point of the material employed, hence stainless appears to be far more efficient for hull buttoms and to give promise of real weight saving.

#### Structures: Refined Theory

Measurement of propeller stresses by the use of plastic compounds which change their electric resistance under stress has now reached a high degree of development at the hands of Hamilton Standard Propeller Co. as reported by A. V. DeForest. With suitable oscillographs and amplifiers it is possible to secure exact records of stress in the propeller blades and to determine the relative vibration phases in opposite blades.

The stress analysis of the old stick, wire and fabric airplane was a relatively simple matter. The stress analysis of a modern all metal, metal skin covered airplane is complex, and the engineers are constantly refining and improving their mathematical methods. The four or five papers on structural theory are of too technical a character to be reported in so brief a report, and only the principal points of these papers can be stated here.

Professor J. S. Newell (*The Need of Empirical Data in Designing Modern Aircraft Structures*) showed that discrepancies exist between theoretical formulae for the crushing stress of corrugated sheet and test data. It is such discrepancies that justify the title of the paper, and the introduction of empirical correction factors into the theoretical formulae. Tests on fuselage models of cylindrical form showed that the maximum stress does not occur at the extreme fiber. If the transverse rings are far apart, the stringer at 45° from the neutral axis experiences the maximum stress. The closer the ring spacing the more stress is thrown into the outer fibers. Here also test data does not seem to conform with theory, and this empirical viewpoint is certain to be viewed with sympathy by practical constructors.

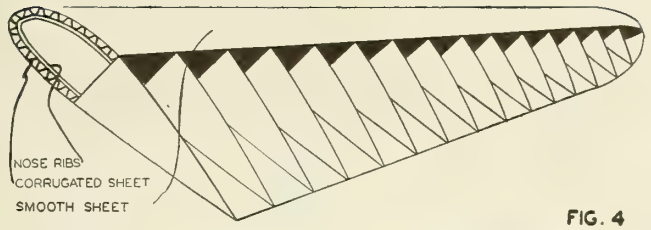



FIG. 4

An extensive treatment of the stresses in fuselage main bulkheads is given in the literature of the art. In general, vertical shear loads are treated as concentrated external loads, which are in balance, and applied at various points on the bulkhead. The equations obtained are valid for this particular type of assumed loading. However, such analysis does not consider the fact that the skin plus stiffeners provide the external reaction which is obviously not concentrated but exists in the form of a distributed load which varies around the bulkhead. The purpose of a paper, *Analysis of Circular and Non-Circular Rings with a Varying Distributed Load* (Louis G. Dunn) was to present a method of analysis in which the wing reactions are balanced by a varying distributed load around the bulkhead. The shear distribution (although not exact because of the interaction of skin and stiffeners) seems, however, closer to actual existing conditions than the method of concentrated loads. The mathematical analysis with this idea as a basis was applied to a particular example of airplane, and the conclusions are interesting. A bulkhead design based on the analysis compares favorably with bulkheads which, through static tests of the completed airplane have proved to be satisfactory from a weight as well as strength standpoint. While the analysis and procedure was entirely specific this novel viewpoint should be of interest to advanced exponents of structural analysis.

Eugene E. Lundquist discussed *The Strength of Columns that Fail by Twisting.* A few basic considerations in twisting failure of columns were presented and illustrated without recourse to detailed mathematics. The conclusions are of direct service to designers.

1—All types of column failure may be classed under (a) primary failure; and (b) secondary or local failure.

2—The critical stress for primary failure which includes twisting failure is given by the equation:

$$f_{crit} = (GJ/I_p)(C_{BT}/I_p)(2_E/L_o^2) \ldots (1)$$

where:

$E$ = tension-compression modulus of elasticity

$G = E/2(1+\eta)$ = shear molulus of elasticity

$\eta$ = Poisson's ratio

$I_p$ = polar moment of inertia of the cross-section about the axis of rotation

$L_o$ = effective length of the column

$J$ = torsion constant for the section

$C_{BT}$ = torsion bending constant, dependent upon the location of the axis of rotation and the dimensions of the cross-section

3—For primary failure, the axis of rotation will take such a position consistent with the conditions of support as will cause the critical stress to be a minimum.

4—When the axis of rotation is at infinity on one of the principal axes of the section, failure occurs by bending and equation (1) reduces to the Euler formula.

5—At high stresses effective moduli $\overline{E}$ and $\overline{G}$ must be substituted for $E$ and $G$ in equation (1).

6—When a column is attached to the skin of a stressed-skin structure and failure occurs by twisting, the skin will resist twisting and another term must be added to the right side of equation (1).

7—When the bending term in equation (1) contributes an appreciable portion to the critical stress, the allowable stress for design is near, if not equal to, the critical stress at which twisting begins.

Dr. E. E. Sechler's *Stress Distribution is Stiffened Panels* dealt with tests on thin plates supported at the ends by V-shaped grooves and at the middle of a hat shaped section. Formulae were derived relating the load carried by the sheet to Young's Modulus, the yield point, the thickness and width of the panel.

#### Engines and Fuels

Major E. E. Aldrin (Stanavo Specification Board) in his paper *Progress in High Octane Fuels* discussed the development and sources of 100 Octane fuel and looked forward to ratings above 100 Oct. in the near future. How the new fuels will be rated depends upon research being carried on at present in new methods of rating fuels above 100 Oct. The present CFR method is only suitable for fuels

(*Concluded on page* 159)

# EDITORIALS

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**"A comparison with the preceding five-year period indicates that although the number of hours flown was 20 per cent greater in 1936 than the average for the five preceding years the frequency of total accidents was reduced by one-fifth. Such an improvement could have been accomplished only through the loyalty and diligence of the officers, enlisted men and civilian employees of the Air Corps, who by intelligent cooperation with the civilian industry and other technical agencies of the government, have so advanced the science of aeronautics."**

***Harry H. Woodring, Secretary of War***

## "At Long Last —"

Eugene Vidal's belated note of resignation might well have been prefaced with the words the Duke of Windsor chose in announcing his abdication—"At long last—." In Vidal's case it was really long, bringing to mind another oft-repeated fervent phrase filled with meaning—"Four long years!"

The present set-up of the Bureau of Air Commerce is such that a strong man is needed. Senator Copeland believes "it won't change things a bit to put in a new director." Well, if we need a new organization *and* a new director, now is the time to do something about it. In the very beginning, trouble portended the appointment of a triple-headed "head" for a post of such importance. Vidal, unfortunately, fell heir to the position in which many a man would have been helpless to function faultlessly.

The Bureau should be headed by one man. But this man must be one whose knowledge of aviation cannot be questioned, and whose authority is not divided.

If we are to learn anything from past mistakes, the President should recommend for this important post someone who knows at least what it is all about, and in whom the industry can place its confidence.

## Aircraft Shows a Business Barometer

New York's first aviation show in seven years offered definite evidence that the "man in the street" has become aviation conscious and that air-mindedness is on the upgrade. Whether this is the result of newspaper accounts of extensive military activity in the air, both here and abroad, or because of a desire to become more acquainted with this newest form of transportation, is immaterial; the acceptance of aviation by the public is important.

This acceptance was shown, in a most practical and indisputable manner—by actual purchases. Exhibitors, skeptical at first, were pleasantly surprised by the number of orders they took at the exhibition. Of course, some of these orders would have been taken even if there was no show, but not a few were chalked up at Grand Central Palace that may not have been, or would have been at least delayed, had not the show been held.

Using the New York exhibition as a barometer upon which to base the output of the industry for 1937, it can be predicted that this year will surpass 1936 by at least 50% in commercial production alone.

At Los Angeles this month, exhibitors may expect to note the growing popularity of aviation by further sales. They can feel they have an important part in educating the public and look forward to a profitable (although exhausting) week at the Pan Pacific Auditorium.

## Accomplishments In Air Radio

The highly specialized field of aircraft radio is on the verge of becoming a big industry. Advances in aeronautics are dependent on the development and use of navigational facilities, of which as yet we have seen just the beginning. Special problems confronting the aircraft radio engineer have no parallel in other applications of radio, and not all of them have been solved. There is need of new knowledge, new apparatus, new technique. Above all, there is need for intelligent coordination of the knowledge already gained, and its practical application to aviation's requirements.

For several years the aircraft radio industry "just growed." Scattered accomplishments had little bearing on the industry as a whole. Radio cure-alls cluttered the market. The necessity for dispassionate standardization of navigational facilities and procedure can no longer be denied. To accomplish such standardization effectively, we must have well-integrated coordinated research, and frank acknowledgment of the inherent limitations of any one system of radio navigation.

With standardization must come expansion of navigation facilities, and unified control of air traffic along crowded airways. The fast military plane, the commercial transport, the private flier in his small ship, have radically different radio requirements and limitations, yet all must use the same radio facilities with safety to themselves and to each other.

In the next eighteen months we can expect more practical attainments in aircraft radio than were accomplished in the past six years.

## "Strike One" on the "Sit-downers"

Employees of aeronautical factories who feel their working conditions unsatisfactory, can settle their real or fancied difficulties with their employers without resorting to sit-down strikes, which result in occupation in violation of the law. Such foreign methods of expressing dissatisfaction by workers might be more appropriately associated with industries which do not require the experience and knowledge demanded, and found, among aircraft workers.

It would be far more beneficial to all concerned if grievances were taken directly to employers through company organizations instead of heeding the racketeering "organizers" (particularly those who have no knowledge of the aviation industry or its problems and whose background consists of "organizing" cloak and suit workers) as they expound the power of the "dog in the manger" sit-down strike.

There are more effective measures to take, and the aviation employee should be smart enough to avail himself of them or else get into some industry where brains and skill are not at a premium and where the dumb sit-down strike is the only recourse of a downtrodden group of menial employees of low-calibre intellect.

Serious-minded workers in the air industry should look into the motives of professional agitators who thrive on artificial strife and discontent.

# Introduction of BENDIX Radio Products



*A local control Bendix direction finder for use with conventional receivers*

● New in name only, the recently-organized Bendix Radio Corporation combines personnel and facilities of Radio Research Co., Washington; Radio Products Co., Dayton; W. P. Hilliard Co., Chicago; and Jenkins and Adair, Chicago. Headed by Vincent Bendix, the corporation's technical development is in the hands of L. A. Hyland, Vice-President and General Manager.

The ambitious project before the company is to supply to the industry every phase of aircraft radio equipment, "from generator to antenna." To realize the magnitude of the project, it is necessary to visualize the widely diverging radio requirements of military, commercial and private flying, on the ground and in the air. To fit these specialized needs, the company will offer a selection of specialized equipment.

For the present we confine ourselves to a summary of the technical side of the company, leaving descriptions of individual apparatus for subsequent issues.

Bendix offers some 15 models of aircraft transmitters, about 10 of which are available commercially. These range from 12 to 100 lbs. in weight, and offer as many as 10 pre-selected crystal-controlled frequencies, between 300 and 12,000 kc. All have one feature in common: they are built to aircraft standards. Compactness of design, accessibility of parts and rugged construction are noteworthy. Novel features include nitrogen-packed transformers, and crystals in evacuated containers. The rapidly varying conditions encountered by aircraft radio were taken into consideration, and all equipment must pass severe routine tests for temperature (—35° to 135° F.), humidity, atmospheric pressure, as well as a strenuous vibration test.

In aircraft receiving equipment, in addition to radio direction finders, 9 commercial models are available, embracing the long-wave radio range beacon band, standard broadcast, and short waves as low as 110 mc. Weights range from 12 to 45 lbs. The logical extension of crystal control for frequencies in reception as well as transmission finds application in several models.

Aircraft radio direction finders are represented by 10 different models, ranging from simple null type homing devices with aural indication, through rotatable loop radiogoniometers with left-right indication, to precision instruments for radio navigation with automatic and continuous indication throughout 360° in azimuth. The direction finders are available as self-contained units and as attachments to conventional receivers.

Ground radio equipment is equally well represented. Multi-frequency transmitters with remotely controlled rapid frequency-changing devices are offered in several models, from small 50-watt airport units to large installations capable of spanning a continent by voice or code.

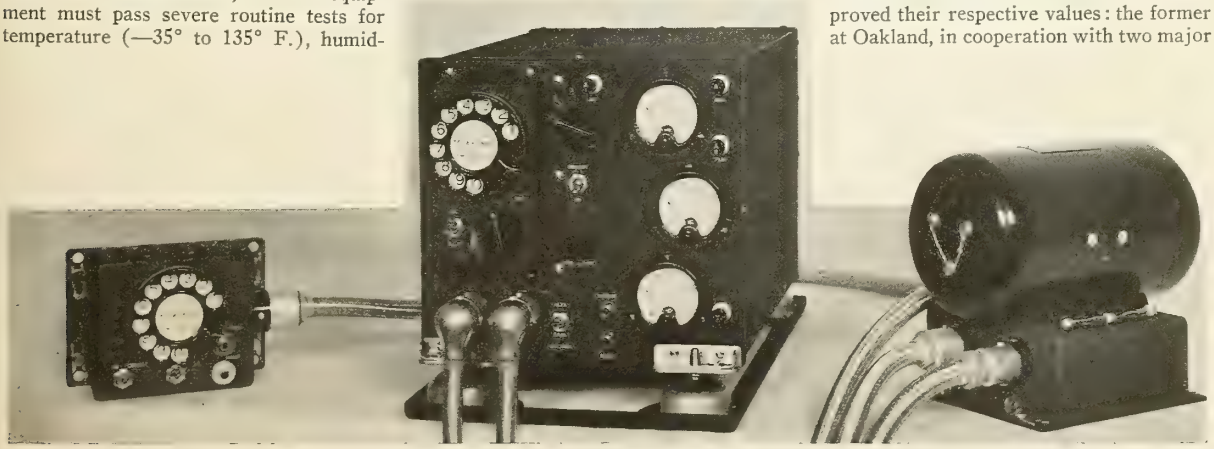
Radio range beacon transmitting equipment, incorporating many improvements recently made possible, is also available, as well as units for modernization of the existing ranges.

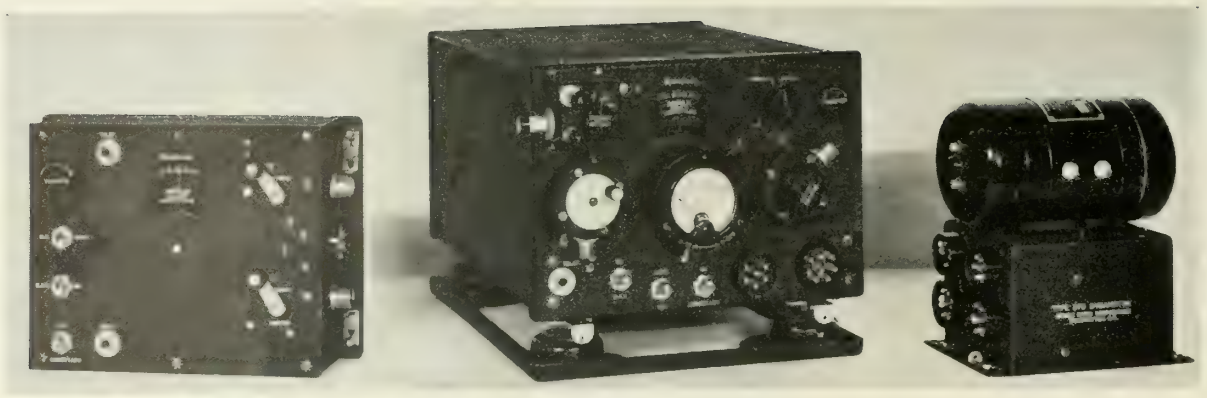
Non-directional ground receiving equipment also embodies many new features assuring better reception over greater range for a given transmitter output; the emphasis, however, is on ground radio direction finders which must become an important adjunct to radio navigational facilities of the near future.

Three types of ground radio direction finders will be offered: large stationary Adcocks for permanent installations; semi-portable equipment for military and auxiliary commercial use; and portable loop direction finders.

Four instrument landing systems will be manufactured. The first two are ready for production: one, for stationary installation at airports, provides three-dimensional "bent beam" landing path; the other, for mobile use, is known as the Army-Hegenberger system. Both systems underwent exhaustive service tests and proved their respective values: the former at Oakland, in cooperation with two major

*Typical Bendix 10-frequency aircraft transmitter for remote or local control. Left: remote control head; center: transmitter; right: dynamotor and filter*





*Typical Bendix aircraft receiver for remote or local control. Left: remote control head; center: receiver; right: dynamotor and filter*

airlines; the latter in the military service.

The two other systems of instrument landing are as yet in the experimental stage. One seeks a straight inclined path with a range of about 30 miles, for use by the large four-engined transports now under construction, and investigates the possibility of applying the revived tricycle landing gear for totally "blind" landings; the other employs television.

Bendix engineers look far ahead and see the still nebulous picture of radio navigational facilities of tomorrow take shape. In their laboratories, orderly research into the little known realms of radiophysics systematically goes on. There are the two new instrument landing systems. There is an automatic "blind" flying drift indicator. Vagaries of radio direction finding are being investigated. Substratosphere conditions are simulated in special chambers.

The visitor to the Bendix radio laboratories is inevitably impressed with the coordination of their research. The interlocking problems of the wide field of aircraft radio are considered not only individually, but in their relation to the navigational facilities as a whole. This is a new and welcome point of view.

## LOOKING AHEAD

(*Continued from page* 23)

best, but a *sixth*-best assortment of airplanes for our defense. In quality they stack up with the best; in quantity we have only 100 more than Japan, 2300 *less* than Great Britain and 1800 *less* than France. Germany, which only started building recently, has 400 more planes than we, and Italy, having left a few in Ethiopia, still has 800 more than we have. Although we're still leading Japan by 100 ships, they're catching up under the vigorous leadership of Air Minister I, Wanta Moto.

When we discuss air defense of our country, we may as well omit calculations on the planes in the Navy—they'll have all they can do to defend the Navy—and its two new battleships now under construction. As those two are representatives of a passing order, I suggest that these battle tubs be named Maine and Vermont, also sunk recently—remember? What remains for the air defense of our fair land, therefore, are the planes in the Army Air Corps and its little G.H.Q. Air Force—G.H.Q. means General Headquarters, not "Gosh! How Quaint!"

Now in the Air Force we seem to be headed right with our attack ships, our bombers, and our pursuits, so far as the airplanes are concerned; but when we look at engines we find all our eggs in that one radial air-cooled basket. I mean no disparagement to that fine and proven type when I urge that the production of large liquid-cooled engines be started as soon as possible, and on a large scale. With what we need right now—not to mention the next ten years—we have enough work ahead of us to run our present engine plants at capacity and half a dozen more on new types.

### A "Defensive Air Force"

Now another thing—we're always talking about a "defensive air force," when the airplane is an offensive, not a defensive weapon. The force may be used in defense of the country, but to defend us it can only act offensively. Even if we build the fastest pursuits possible, with the biggest streamlined engines, we have only a close-in defensive force—a type of force that many consider already obsolete, except for home-consumption propaganda purposes. I don't agree with that theory, for I don't agree with the Douhet doctrine. But I have seen for some time, the pressing need for a new type of weapon to be used against bombardment fleets. And that is the multi-engined fighter, or Bomber-Destroyer, as I call it.

We're still playing around with little .30 and .50 calibre machine guns and—at this one our eyes bug out with admiration!—the little 37 mm. cannon. That's all nursery stuff, the infantile beginning of real air hitting power. It's true you don't need a 3-inch shell to knock down any airplane. But you do need a ship capable of carrying a weapon that will fire a shell into a fleet of bombers *at such a range that the bombers cannot fire in return with their machine guns.* Right now we should have a practical, accurate 75 mm. cannon, and in five years we should have a much larger weapon capable of firing a small shell accurately for several miles. The Navy does it on the water. Why don't we do it in the air? The answer is that we haven't learned to think in terms of air power, so we don't spend the money necessary to develop these things.

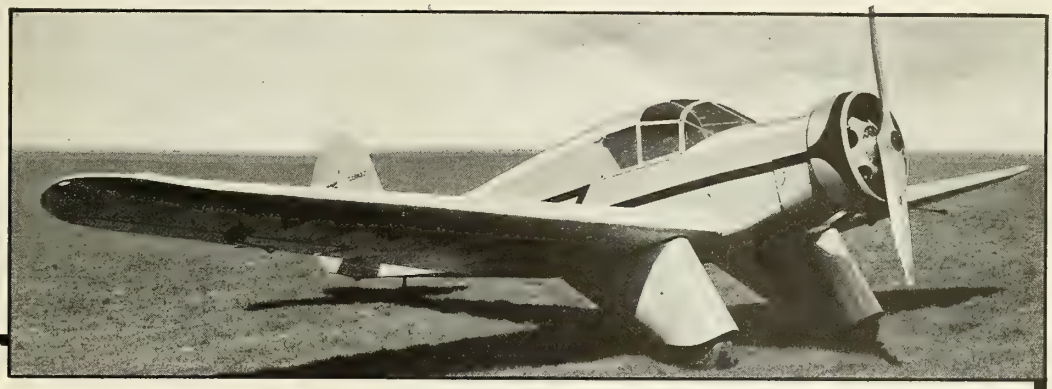
What we need, therefore, is a fast multi-engined ship with one cannon that can be sighted and controlled accurately. We need a weapon that will outrange any that the bomber can carry—and he can't carry a cannon and shells and a load of bombs all at one time. Have the firing range of him, beat him in speed and hitting power, and then you can destroy him, wherever found. You don't have to wait until he's over a large city before you send a pea-shooter up to try find him.

My vigorous friend Major Al Williams, recently returned from a survey of European air matters, says "We are five years behind Europe in having anything like a full quota of aircraft engine types for our air defense. And this is 10 times more serious than merely lacking airplanes." He mentions also the compression-ignition type of engine using crude oil, commonly called Diesels. That is just the type of engine for a long-range aerial Destroyer or Cruiser—and we have no Diesel engines in large sizes, except in the experimental stages.

It's no use thinking that just because we're Americans we *must* be ahead of the world: We're away behind in several aeronautical respects, and it is up to us to catch up—and up to the Government to appreciate the fact and pay the cost.

# SIX YEARS' PERFORMANCE on the C-3 EARNS ITS RIGHT to be on the AERONCA LOW-WING!





FEW are the registered thousands of airports in America that do not have an Aeronca C-3 glide down onto the runway. For it's that kind of ship. World famous, nationally popular, it has earned its way into private flying on performance.

So it's important news when a firm renowned for this ship, adopts that super-soft shock-absorbing air cushion—the Goodyear Airwheel* for its newest contribution to the airlanes—the new Aeronca low-wing.

In making the decision J. C. Welsch, for the Aeronautical Corporation of America, writes: "As you know, we have been using Goodyear Airwheels on the Aeronca C-3 for the past six years. After having exceptionally satisfactory service from this equipment we did not consider it necessary to look elsewhere for wheels, tires or brakes for our new low-wing. This makes use of Goodyear wheels, tires and brakes 100% on Aeronca models."

In countless tests Goodyear Airwheels have proved they are the safest equipment under-wheel. They literally cushion every landing. They turn forced landings in plowed ground, corduroy fields and snow and sand into smooth landings. They are particularly a safety factor in student flying. They relieve all ships of the ground strain and stress of any landing and they lighten the shock of every bounce-in landing.

Adding all these up it is easy to understand why more and more manufacturers are choosing Goodyear Airwheels. And why more and more passenger lines are adopting them for every ship in the run. Perhaps they are enough reasons for you to switch over to Goodyear on your own ship—remember Airwheels are first choice for safety.

***IF IT ISN'T A GOODYEAR IT ISN'T AN AIRWHEEL**

AIRWHEEL *is Goodyear's trademark, registered in the U. S. A. and throughout the world, and is used to denote that Goodyear is the exclusive maker of* AIRWHEEL *Tires*

THE GREATEST NAME IN RUBBER

GOODYEAR

**ON YOUR NEW SHIP SPECIFY GOODYEAR AIRWHEELS AND GOODYEAR AIRPLANE BRAKES**

# AERO *RADIO* DIGEST

## Newest Developments in the Field of Aircraft Radio

### TWA Loop

The TWA rotatable loop direction finder is the most elementary and the simplest device of its kind developed to date, and indicates the current trend towards simplification of radio aids. It serves the dual purpose of eliminating rain static (AERO DIGEST, December 1936), and provides direction and position finding.

The loop is mounted underneath the fuselage and may be rotated by a small crank located in the pilots' compartment, alongside a 360° card where the position of the loop is indicated by a direct-geared pointer. The card is calibrated to allow for the electromagnetic effect of the ship's structure, the degree marks showing the direction of the incoming signal and not the physical position of the loop. This calibration holds true for only one loop unit location in one type of ship.

A conventional receiver is used and signal reception is aural. For non-directional use, the pilot aligns the plane of the loop with the source of signal. In this position, the signal intensity is at its maximum, and the pilot may listen to the station and identify it. Since responsiveness of a loop varies as the cosine of the angle between the plane of the loop and source of signal, good aural reception is possible within an angle of about 30° to either side of the plane of the loop.

For directional use in homing or position finding, the pilot turns the loop to its null position (at right angles to signal), where the signal disappears, and notes the station bearing on the card.

The resolution of the 180° ambiguity, (i.e. determination of whether the station lies ahead or astern) is accomplished by maneuvering the ship as follows: First, the pilot aligns his ship with the signal by placing the loop at right angles to the ship (loop pointer reads 0°), and turning the ship itself until the signal disappears. He then sets his directional gyro to 0°, makes a 90° turn to the left, and after a few minutes resumes his original 0° gyro bearing. Taking his radio bearing anew, he notes whether the pointer moves to right or left of the original 0° position on the card, and adds or subtracts 180° according to instructions: the right side of the card is green, marked "add;" the left side is red, "subtract." This simple procedure materially aids the busy flight crew in using the instrument.



*TWA loop and control unit*

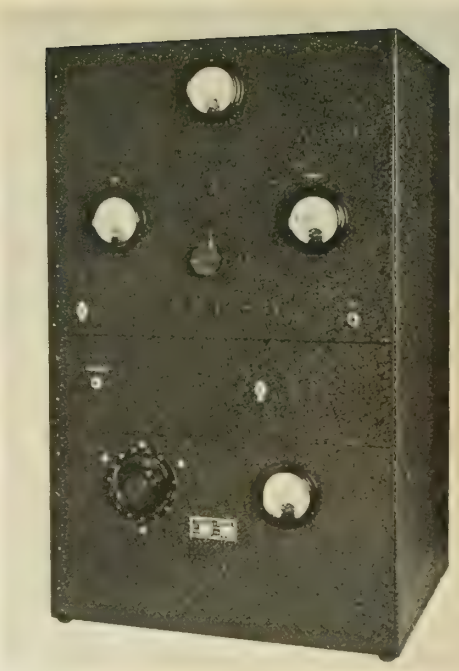
### Leadless Mycalex

A new insulating material especially suited for aircraft radio work has recently been developed in England and is now available in this country. The material consists of pulverized electrical glass and mica mixed and baked under pressure in the presence of a chemical agent, forming a hard homogenous mass. This is an improvement on the original Mycalex which employed lead borate as the agent.

The material is available in sheet and bar, as well as in special forms, and can be readily machined to high tolerances. All machine shop operations, such as sawing, stamping, drilling, threading, turning, milling, and polishing, can be performed, making it particularly valuable in experimental work.

Mycalex has found favor in aircraft service, where quantities are comparatively small, weight is an important factor, and varying conditions of temperature, pressure and humidity make heavy demands on insulating materials. Numerous instances of its use under service conditions brought out many desirable characteristics, ranging from reduction in weight to increased electrical efficiency of radio apparatus.

Leadless Mycalex is manufactured in this country by Electronic Mechanics, Inc., New York.



*Harvey 200-S 50-watt airport transmitter*

### Airport Transmitter

Harvey 200-S 50-watt transmitter, available in a frequency range of 1500 to 7000 kc, has been installed in ten airports throughout New England. It has provision for selecting as many as 8 preset frequencies by the single front panel control. The transmitter is also available for airport service on any single frequency between 250 and 550 kc.

For multi-frequency operation, all crystals are permanently mounted on the chassis and are selected at will by a control switch mounted below the chassis and coupled by chain and sprocket drive to the main shaft directly above. This shaft actuates band change switches simultaneously with the crystal selector, contacts the proper turns on the oscillator and amplifier plate coils, and selects the proper oscillator plate tuning condenser for the working frequency. No coil or crystal changing is necessary in selecting the frequencies, and there are no circuits in the transmitter requiring neutralization.

In the audio section, suppressor grid modulation is provided, and because of the small audio power required by the RK-28 tube for complete modulation, the modulator section is compact. The speech amplifier uses a 6J7 and 6C5 resistance coupled to the 6F6 pentode modulator and is designed to operate with a crystal type microphone. The modulator chassis also carries a 1000-cycle audio oscillator to provide a tone for MCW transmission.

The 200-S is housed in a steel cabinet finished in black wrinkle and fitted with removable rear door. These transmitters are manufactured by Harvey Radio Laboratories, Inc., Brookline, Mass.

### Lear Two-Way Radio

Inexpensive light-weight two-way radio equipment for private pilots has been announced by Lear Developments, Inc. The equipment consists of Learadio R-3 receiver, Learadio T-30 transmitter with an At-cut crystal ground to .02% of 3105 kc., T-30 dynamotor, microphone, telegraph key, connecting cables, and antenna kit.

The R-3 receiver covers 3 bands: 200-400, 550-1600, and 2400-6500 kc., and operates from a standard 12-volt battery and the T-30 dynamotor. The receiver employs 4 tubes and weighs 5 lbs.

The T-30 transmitter has a frequency range of 2800-6500 kc., with the itinerant frequenty of 3105 kc. crystal controlled. It is compact, measuring only 7″ × 6″ × 7″ overall, and can be mounted on dash, ceiling, or under the seat. Inter-cockpit telephone communication is provided when transmitter is not radiating.

The dynamotor is supplied with 8 ft. of battery cable, and 15 ft. of cable to run to the transmitter.

The total weight of the entire two-way system is only 24 lbs. and the equipment can be easily installed in average private ships.



# *The Aviation Viewpoint in*
# AIRCRAFT RADIO

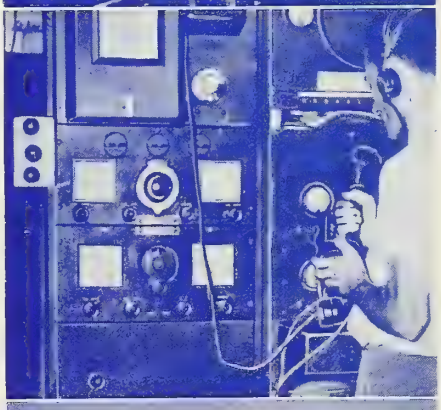


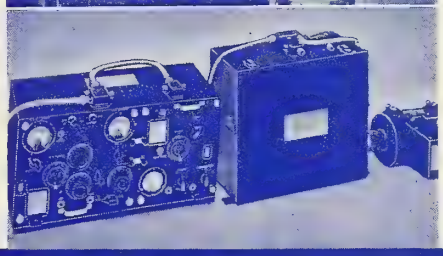
Hundreds of years of aircraft radio experience and thousands of flying hours have been accumulated by the Bendix Radio Corporation engineering staff.

One of the Bendix Aviation group of companies, Bendix Radio Corporation has available the finest engineering facilities in the world, assuring coordinated design from generator to antenna.

Every radio device utilized by commercial, naval and military aviation, whether in the air or on the ground, is produced by Bendix Radio Corporation.







## PARTIAL LIST OF AVIATION PRODUCTS

- Transmitters
  - Intermediate Frequency
  - High Frequency
  - Super Frequency
- Receivers
  - All wave
  - Beacon
- Direction Finders
- Radio Compasses
- 'Approach' and 'Glide Path' Landing Systems
- Radio - Autosyn Indicators
- Hydraulic Rotators
- Intercommunicating Telephones
- Ground Station Equipment
  - Traffic Control
  - Transmitters
  - Receivers
  - Radio Ranges
  - Field Localizers
  - Marker Beacons
- Quartz Crystals and Holders

## CONSOLIDATED COMPANIES

RADIO RESEARCH COMPANY, INC.
THE RADIO PRODUCTS COMPANY
W. P. HILLIARD COMPANY
JENKINS AND ADAIR

# BENDIX
## RADIO CORPORATION

New York . . Washington . . Dayton . . Chicago . . Oakland

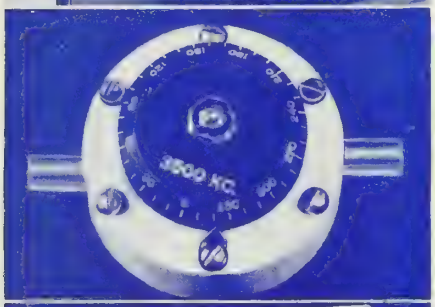
Photos Courtesy U. S. Dept. Commerce

Direct all correspondence to
BENDIX RADIO CORPORATION
9th and Kearny Sts., N. E.
Washington, D. C.



# BENDIX
# *on the* ETHER WAVES










"Radio in all its applications to pure and applied science . . ." defines the scope of Bendix Radio Corporation.

Bendix Radio Corporation provides unique research engineering and manufacturing facilities through the consolidation of four widely known radio equipment manufacturers.

The large broadcasting companies and the military, naval and commerce departments of the various governments who are entrusting their problems to Bendix Radio engineers bear testimony to the reliability and superiority of Bendix Radio products. Bendix products have long been world leaders on highways, waterways and skyways . . . they now assume a dominant place on the ether waves.

## PARTIAL LIST OF RADIO PRODUCTS

Hurricane-proof Spike Antennas
Antenna Arrays
Frequency Standards
Frequency Monitors
Frequency Meters
Low Temperature Coefficient
Variable Condensers
Fixed Condensers
Inductances
Precision Gear Drives
Synchronizers
Audio Analyzers
Modulation Monitors
Tube Testers
Set Testers
Remote Control Devices
Quartz Crystals and Holders
Capacity Standards
Field Intensity Meters

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New York . . Washington . . Dayton . . Chicago . . Oakland

Photos Courtesy U. S. Dept. Commerce

# Personalities

by Caldwell

Young man, you're wasting time and bothering busy people if you run to airlines and airplane and engine factories crying hopefully, "Here I am, as God and the local High School made me." God and the high school haven't done enough for you, and you're out of luck. Preferred to you every time will be the young man who has been trained in some technical aviation school—trained at least to the extent of starting intelligently with some useful practical knowledge and craftsmanship that will be of value to an employer. You can no more expect to start untrained in aviation than you could start untrained and hang up your shingle as a doctor or a lawyer. They don't even want you to "sweep out the factory"—a job that a lot of boys say they want to start with. They have an old fellow to do that because they think he's more reliable than a young one—and he invariably is.

### Getting a Start

If you would start in aviation get yourself a technical education in some one phase of the business in one of the many excellent aviation trade schools in this country—and don't ask me which one. Pick out one for yourself, I'm neutral. One annoying thing about these schools is that you have to work in them and study, or all the instructor's efforts will bounce off harmlessly, and when you come out again people will think you went through wrapped in cellophane. I hate to destroy a boy's illusions, but truth compels me to report that we and the ants have to work—darn it! By the time you reach my age you get kind of numb, and it doesn't matter. For instance, I worked until four o'clock this morning on my third play—and nobody's produced my first one yet! Well, we either work out or rust out, and I object to rusting. And either way, we're tired at the end.

These somewhat distressing reflections were induced by a recent visit to the Manhattan High School of Aviation Trades where I was called upon by Dan Brimm to address the graduating class and start them off with a feeble cheer for a life of toil. Such old toilers in the aviation vineyard as Jimmy Taylor and Dick Depew were also on hand to welcome these youthful recruits to our industry and to tell them that if they worked hard they would some day be just like us—tired.

Daniel J. Brimm, Jr., is the engine instructor at that school, a New York city public school that used to teach the building trades but now specializes in the mechanical end of aviation—nobody wants to build houses any more, apparently. When Brimm started teaching there in 1933, they had 200 pupils; now they have 2500 and are crowded for room in a huge building. Many of the students come of poor parents; few of them have much money; some have lacked even car fare and have had to walk miles each day to and from that school, carrying their lunch, when there was any lunch to carry. Some looked much like what a Park Avenue resident would call "an East Side mug,"—he in turn would look upon the socialite as a sissy, one far beneath a good embryo mechanic, in everything but the change pocket. Some of these boys started without any of the usual advantages; but the City of New York has given them an education, and now they're going places, the good ones, no doubt of that. A slight education and the stamina to put up with working is all that anyone needs in this country—depressions and rabble-rousing politicians to the contrary notwithstanding or sit-down striking.



*Daniel J. Brimm, Jr.*

### A Real Old-Timer

Dan Brimm is one of the real old-time pilots, born the day before the Fourth of July, back in 1894, in Columbia, S. C. His father was president of Columbia Theological Seminary at the time, and is now professor in Presbyterian College, Clinton, S. C. Dan's mother, prior to her marriage, was a school teacher, so Dan comes naturally by his teaching ability. He loves the work, too, and tells me that he'd sooner take that raw East Side material—and some of it is very raw!—and turn it into good useful citizenship than he would design a new airplane and fly it. He says there's some doubt whether the airplane may be considered an asset to civilization, especially in Spain, but a good citizen is always an asset.

During week-ends and vacations Brimm does test work and general free-lance flying—his last test job was the Fleetwings *Sea Bird*. He is also literary and has got out a book with Eddie Boggess, *Airplane and Engine Maintenance*, which is going well. He has completed another: *Seaplanes—Handling, Operation, Maintenance*, now on the press. Both are published by Pitman. He also has written magazine articles and been paid for them, and expects to continue indefinitely as a writer, test pilot, plain pilot, and engine instructor to the end of his days. The amazing energy of these old pilots! It tires me even to think of it.

Dan Brimm, unlike most old pilots, was smart at school. He finished high school when he was 13, college, with a B.A. degree at 17, and got an M.A. when he was 18—a mental prodigal, as Jimmy Durante would say. He took a job teaching for four years—Latin and English. In 1917, turned down for military service because of a bum eye, he started in aviation—sweeping floors in the Benoist factory in Sandusky, Ohio—for at that time there was a shortage of old fellows who wanted to sweep floors. He went next year to the Thomas-Morse Co., Ithaca, as a draftsman who didn't know anything about drawing. But he learned, and in 1918 joined the Gallaudet Co. in East Greenwich, R. I., studied engineering at night, and became one of their designers. In 1922 he became project engineer with the Curtiss Co. in Garden City, where he ran through several types, the last being the Curtiss *Carrier Pigeon*, a peculiar ship with square corners everywhere, which I once infuriated Casey Jones, who was flying the thing in the first Ford Tour, by calling it the bird that lays square eggs. Incidentally, Tex Bohannan would like to know where he can get one of those old Pigeons; says they're swell!

### Goes to Ireland

In 1925 Brimm left Curtiss to become Chief Engineer of Ireland Aircraft, Inc., where he was responsible for the noisy atrocities that were among the first of the commercial amphibions. He test flew all of these, having started flying in the Benoist boats in 1917, and continuing on Jennies after he went with Curtiss. Sumner Ireland sold his interests in 1930, and left the company, followed shortly by Brimm, who started a flying service at Flushing, L. I.—Knickerbocker Aviation, Inc., with two other hopefuls. It was successful for a time, but he left it in 1932 to operate a seaplane service in Port Washington, among the nibs, which gave him a high degree of polish and social grace, now useful on the East Side of New York. He lives in Port Washington and commutes to work by seaplane when the ramps are open—under the personal supervision of Bob Lyon, New York City's old ramp-opener—and closer.

# LIFE...




*The Texaco service truck is a familiar sight at most important airports. A majority of the transport airlines operate on Texaco Products.*

# TEXACO

# *that's* WHAT IT HAS!

To be assured of *maintained* top performance, your engine requires oil that has exceptionally long life . . . oil that can stand up under the strain of high engine output hours on end.

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# *Aviation Products*

# EQUIPMENT and METHODS

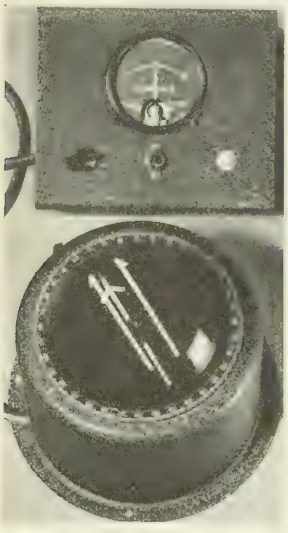
## Some New Devices Seen at the New York Show

● An inspection of exhibits at the New York National Aviation Show last month revealed an unusual number of new items of equipment which are of more than passing interest. Particularly was this so of the propeller exhibits where three new types were shown for the first time.

Attracting attention because of their unconventionality as well as because of their possibilities of increasing aircraft performance, the one-bladed Sensenich Bros. propeller and the Maynard-Di-Cesare propeller with offset blades, were perhaps the two items which aroused comment and discussion among exhibitors and visitors.

### Telemagnetic Compass

The West Telemagnetic Compass, shown for the first time during the show, embodies an entirely new method of remote compass



*West aperiodic type compass*

reading. The left-right course indicator on the instrument board, activated from a capacity change within the magnetic compass, faithfully follows any deviation from the pre-selected course. The sensitivity of the dashboard indicator may be adjusted by the pilot to suit his needs, depending on the directional stability of his craft and also, air conditions.

The compass is of aperiodic type, arranged for parallel grid reading, and is extremely readable. The compass needle is housed within a spherical glass bowl 5" in diameter, mounted within the course-setting ring. Indication is unaffected by dip not exceeding 10° from the horizontal, and the parallax error is eliminated within that range.

An extremely small condenser plate secured to the compass needle, and two others secured to the compass bowl operate the remote indicator. As the ship swings in azimuth, the movable plate passes closely by (but always equidistant from) the two stationary plates, and the remote indicator is made exactly responsive to this capacity change by a miniature vacuum tube oscillator located directly underneath the compass.

Installation is simplified by the fact that the compass may be located in a region of minimum deviation, while the remote indicator is placed on the instrument board without regard to magnetic fields.

### Supreme Propellers

Appearing as all-metal units for the first time, the Supreme line of propellers was exhibited by Barkley-Grow Aircraft Corp., the Detroit manufacturer now producing this product. Under the direction of M. J. Stone, the original designer and builder, the new Supreme propellers are of cold rolled, low carbon steel, electrically welded in assembly. These are now available for engines of 50 to 125 h.p. and in diameters from 6' 8" to 7', while others for engines from 25 to 50 h.p. and 125 to 210 h.p. are now being developed and will be available about May 1.

### Offset Propeller

Representatives of the Maynard-DiCesare Propeller Corp. (Milwaukee, Wisc.) in describing their product, pointed to a decided blade arc and offset blades on the hub. The arc of the blades acts to bring the point of fatigue 4" closer to the hub than on conventional propellers, providing (with the offset blades) balance, elimination of vibration by action similar to a fly wheel, and efficiency.

The arced blades, it is claimed, incur a larger air stream by a larger bite of air, this air stream leaving the blades at a sharp bias and being directed under the plane.

The propeller is simple in construction and has comparatively few working parts. Blades and hub are all-steel, solid, made under the control of the Maynard Electric Steel Casting Co. of which the propeller company is a subsidiary.

### Switlik Cub Chute

Specially designed for use in a Taylor Cub, the new Switlik *Com-Pak* quick attachable seat parachute is one of the few parachutes made especially for a particular type of airplane. Use of this parachute allows original head room to be maintained, both in front and rear seats through the employment of special replacement seat buckets. Measuring 11.5" across, the pack fits into the replacement bucket and its top comes to the same level as the original seat cushion. Ease of entering the ship is possible, since the pack is placed in the seat while detached from the harness.

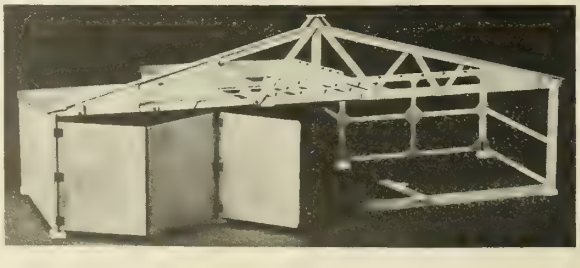
### Cell-Sealed Rubber

Described as "air bubbles sealed in rubber," Rubatex, a new discovery in the rubber industry is manufactured by Virginia Rubatex Corp., Bedford, Va. It is a soft and resilient material, water and vermin proof and of light weight. In aircraft it can be used for a multiplicity of purposes, including insulation against heat and cold, as well as sound, for vibration dampening, and for upholstering floors and side walls. The upholstery material comes in varying thicknesses.

### Pre-Fabricated Hangar

The private-owner hangar manufactured by Montgomery & Bacon, Towanda, Pa., was displayed as a model 1/12 actual size. The model was so designed as to show the structure in process of assembling. The method of bolting together the pre-fabricated units was clearly illustrated.

Built to meet the demands of the private aircraft owner, the M & G hangar has been stressed to withstand wind and snow loads common to open spaces, and yet be readily assembled by a purchaser with no previous experience in building procedure.

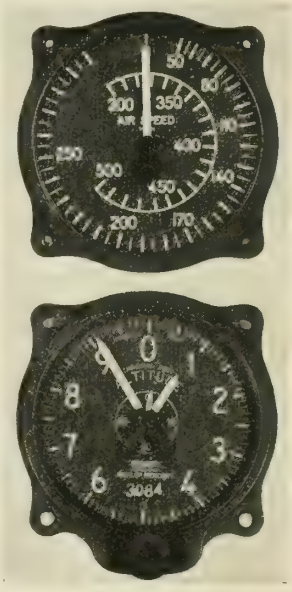


*Model of pre-fabricated hangar*

### Instruments

In the impressive array of Pioneer instruments were a new sensitive altimeter and airspeed indicator, two instruments which assume an important role in blind flying.

The new altimeter is calibrated for an altitude of 35,000 ft. and is provided with three pointers: a long pointer which makes one




*Above: Pioneer airspeed indicator; below: new sensitive altimeter*

revolution for each 1000 ft.; an intermediate pointer which makes one revolution for each 10,000 ft.; and a small pointer which makes one revolution for full range. In the lower portion of the dial is a direct reading barometric setting which provides information for compensation due to changes in barometric pressure.

This latter feature is helpful since it separates the barometric setting from the altitude scale, thus eliminating danger of erroneous interpretations.

Indicating speeds within a range of 0 to 500 miles, the new airspeed indicator illustrates the advances made in speeds within the past few years, inasmuch as older type indicators were calibrated up to 200 m.p.h.



*Cy Caldwell*

# "Sure, I Crossed His Palm With Silver"

KARL ORT

• In the February, 1937, issue of AERO DIGEST Cy Caldwell refers to a fellow who impugns (some word) his honesty in a "not too nice" letter. Said he—"This fellow Ort musta' crossed your palm with silver. Else how come the free advertisement for this patient struggler in the marts of trade?" Says I—"Let's look at the record."

Paging over musty records as far back as 1923, I was chagrined to find the accusation partly true. I have been crossing his palms (not Cy Caldwell's, but Frank Tichenor's, his boss man) with silver—and I mean plenty of silver—for nigh onto 15 years. R. C. Johns, advertising manager of AERO DIGEST, acted as go-between in these negotiations.

The amount involved was up in the thousands. Important money in fact. What portion of this immense sum drifted or seeped down to Cy Caldwell's hands I am unable to say. Only Frank Tichenor knows that. And he won't talk—or testify (Page Mr. Townsend).

If interrogated by a congressional committee of investigation I would have to admit that I did cross Cy Caldwell's tonsils with likker in my hotel room on at least three different occasions in as many different cities. But never the palms with silver. Fact is, I plied Cy with likker all these years, not because I expected to get free publicity for my business, which was *nonexistent* then, but because (I must break down and confess it) I figured that if I gave him sufficient fire water he might be accommodating enough to drink himself to death. And there was I waiting with open arms for his job—application already made out and filed for any emergency. But woe is me, he drank and he drank and he drank and he puffed and he puffed and he puffed (his rotten pipe) but he wouldn't die. I nearly did though, so I gave up the frontal attack—and tried to sneak in the back door. Strategy, eh what!

Believe it or not, out of seven or eleven aeronautical magazines, not one offered to pay me for any or all of my infamous witticisms. Finally in utter desperation, I was compelled to pay them. Kind'a mean about it too. Insisted on this little by-line on every contribution—"Advertisement." And me payin' them regular. Not sportin' at all, is it? Wish I could sue some of them and get the *do re me* back. Attorney says no chance.

Well, I can't afford to spend $200.00 to answer some punk's 3c letter (whose cognomen I don't even know) so I guess I'll tell you about my new catalogue. Right soon (as soon as this mag is published) I hope to have ready for distribution a new 1937 catalogue of 36 pages just cram full of aviators' needs. Not a thing in here for aircraft repair or replacement. That comes later. But everything for personal use. The finest assortment of the finest pilots' equipment of excellent quality. And nothing else but! Price one dime. One teeny, weeny, lousy dime. Thick or thin, they are all the same to me. Yes, I know there are a dozen others both large and small—at no cost at all. And Sears Roebuck's, with 1200 pages; but why bring that up. Only from me can you get information, savings, quality and amusement all wrapped up in one piece. (Price 10 cents.) It's nothing for some good friend to send me 25c, 50c or even a buck for my catalogue after he sees it.

Read what a customer says, "I am sorry that I did not hear of you and your company before I bought my flying togs, for, just for example, I bought a pair of Resistal goggles (sales tag enclosed) which I paid seven dollars and tax for, and which I find you to be selling at only four dollars and fifty cents. How you get the low prices, I guess is your own secret; but I know where to go when I want something."

Even if I never made a dime, I'd still be in this business because you know I was an aviator long before I ever sold a helmet or a goggle. I get more kick out of this business every year and get no end of fun and pleasure out of the friends I make and the letters they write me.

Send one dime today (Canada 20c) for this swell piece of literature—or two, if you want the aeronautical supply catalogue, also; but don't expect the aeronautical supply catalogue for at least 60 or 75 days. You get the Aviator's catalogue of personal equipment right away.

Compiling these catalogues is slowly but surely driving me nuts; however, I find that one gets out of catalogues or life itself just about what one puts into it. Here's a splendid catalogue that's hard to get. You gotta *buy* it—but it's worth it, every cent. Double your money back if you say it ain't. And you get your dime back with your first order, anyway. Write me at 628 W. Poplar Street, York, Pa.

*Yours until your tail skid wears out,*

ORT

P.S. If you are interested in seeing mimeographed copies of the actual correspondence between Cy and me, I'll be glad to have copies prepared and forwarded to you for two bits. A worth-while glimpse into our private lives.



***Here's a picture of me and Rex and Ed. It ain't got a dang thing to do with the catalogue or my business either, but I thought you might like to see what a swell dog I got. And Ed's a swell friend, too; taught me to hunt ducks and geese, and to fish for deep sea fish at a time when I was so steeped in business that I almost forgot there were such things as hunting and fishing. Friends are great things to have. I hope you have plenty. I know if we do business together, we'll be friends, too. If we can't do it that way, I don't want it at all. Write your name and address on a piece of paper and wrap it up around your dime. Stick same in envelope addressed to 628 W. Poplar St., York, Pa., and the catalogue is yours.***

# RECENT AERONAUTICAL PATENTS

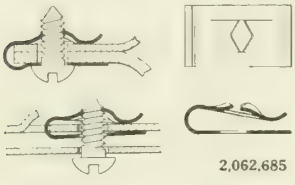
● The following recent patents of interest to readers of AERO DIGEST were compiled from the Official Gazette of the United States Patent Office:

Design for an airplane. Dean B. Hammond, Ypsilanti, Mich., assignor by mesne assignments to Stearman-Hammond Aircraft Corp. (design 102,300)

Position finder, and navigating instrument. Frederick Hayes Hagner, San Antonio, Tex., assignor to Position Finder Corp. (2,064,061 and 2,064,062)

Internal combustion engine. Philip Reimherr, Troy, N. Y. (2,064,082)

Fastening device. George A.

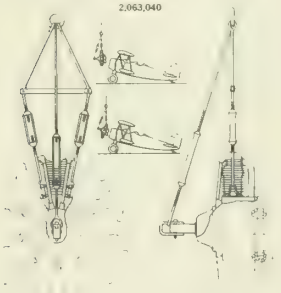



Tinnerman, Rocky River, Ohio assignor to Albert H. Tinnerman. (2,062,685)

Airplane. Walter W. Rothenhoefer, St. Louis, Mo. (2,064,223)

Airplane. Oscar D. Payne, Ft. Worth, Tex. (2,063,005)

Hoisting sling. Carl H. Jolly,




U. S. Navy. (2,063,040)

Process for improving the resistance to corrosion of aluminum base alloys, and aluminum alloys. Adolf Beck, Bitterfeld, Germany, assignor to I. G. Farbenindustrie Aktiengesellschaft. (2,063,022 and 2,063,023)

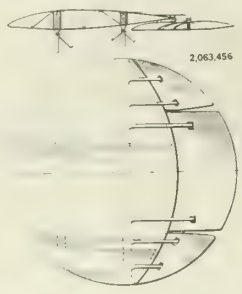
Brake. Vincent Bendix, South Bend, Ind., assignor by mesne assignments to Bendix Aviation Corp. (2,063,024)

Aircraft. Rupert J. Goodman Crouch, Providence, R. I. (2,063,030)

Speed control of landing gear wheels on airplanes. Charles D. Fator, San Antonio, Tex. (2,063,032)

Vibration indicator. Edgar Joyce Schnaitter, Beloit, Wisc., assignor to Fairbanks, Morse & Co. (2,063,127)

Small-aspect-ratio wing. Stef-




fen P. Nemeth, Chicago, Ill. (2,063,456)

Mechanical dynamometer. Emory N. Kemler, Glenshaw, Pa., assignor to Gulf Research & Development Co. (2,063,169)

Device for elimination of piston flutter. Dale J. Wherry, Des Moines, Ia. (2,063,210)

Aviation training machine. Levitt L. Custer, Dayton, Ohio. (2,063,231)

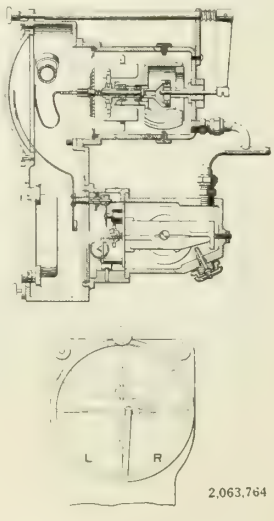
Silencer for internal combustion engines. Giorgio Bacchetti-Righetti, Rome, Italy. (2,063,270)

Apparatus for measuring the stiffness of flexible materials. Ralph F. Taber, N. Tonawanda, N. Y. (2,063,275)

Supercharging system for aircraft. Franklin Young, Glendale, and Richard F. Hardin, Los Angeles, Calif. (2,063,477)

Automatic piloting system. Marcel Wallace, Staten Island, assignor of one-third to Edward L. Corbett, New York, N. Y. (2,063,534)

Combination flight instrument.




Wesley L. Smith, Cranford, N. J., assignor by mesne assignments to Eclipse Aviation Corp. (2,063,764)

Starting device. Stanislas Hertz and Maurice Pierre Berger, Paris, France. (2,063,251)

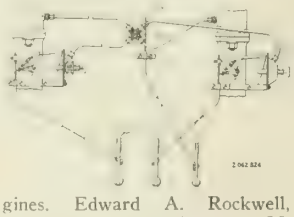
Means for cooling the valves in internal combustion engines. Alessandro Baj, Milan, Italy. (2,063,779)

Vibration recording instrument. Victor E. Corbonara, Rockville Center, N. Y., assignor to Bendix Aviation Corp. (2,063,790)

Airplane control. Wallace O. James, New York, N. Y. (2,063,812)

Injection internal combustion engine. Alfred Meyer and Eugen Holzbaur, Stuttgart, Germany, assignors to Robert Bosch Aktiengesellschaft. (2,063,848)

Apparatus for controlling en-




gines. Edward A. Rockwell, Chicago, Ill., and Sherman M. Fairchild, New York, N. Y. (2,062,824)

Collapsible turtleback, and amphibion landing gear. Guy A. Luburg, Snyder, N. Y., assignor by mesne assignments to Curtiss-Wright Corp. (2,064,673 and 2,064,675)

Airplane lighting system. John B. Bartow, Blue Bell, Pa. (2,064,722)

Bomb support. Ralph D. Carleton, Snyder, N. Y., assignor by mesne assignments to Curtiss-Wright Corp. (2,064,729)

Navigational instrument. Henry M. Jensen, U. S. Navy. (2,064,917)

Electrically-controlled valve. Robert J. McFall, Cherrydale, and Frank H. Roland, Ashton Heights, Va. (2,064,935)

Bomb sight for dive bombing. Henry W. Wickes, Winthrop, Mass. (2,064,964)

Directional system for landing of aircraft. August Leib, Berlin, Germany, assignor to Telefunken Gesellschaft für Drahtlose Telegraphie m.b. H. (2,064,171)

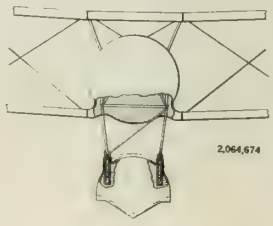
Apparatus for displaying aerial signs. Henry H. Richardson, Louisville, Ky. (2,064,218)

V-type engine frame. George J. Wohanka, St. Louis, Mo., assignor to Busch-Sulzer Bros. Diesel Engine Co. (2,064,282)

Frequency control system. Walter G. Cady, Middletown, Conn., assignor to Radio Corporation of America. (2,064,289)

Carburetor. James L. Edelsn, South Bend, Ind., and Scott F. Hunt, Detroit, Mich., assignors to Bendix Aviation Corp. (2,064,596)

Flexible flotation gear. Guy A.




Luburg, Eddie Molloy, Buffalo, and Frederic E. Flader, Kenmore, N. Y., assignors by mesne assignments to Curtiss-Wright Corp. (2,064,674)

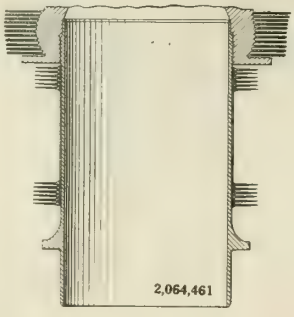
Method of and apparatus for guiding aircraft in landing. Georg Foges, Prague, Czechoslovakia. (2,064,599)

Starting mechanism. Raymond P. Lansing, Montclair, N. J., assignor to Eclipse Aviation Corp. (2,064,670)

Pressure indicating wrench. Karl Pfeiffer, Detroit, Mich. (2,063,622)

Combined punching and riveting machine. William E. Marchant, Detroit, Mich., assignor to Engineering & Research Corp. (2,063,691)

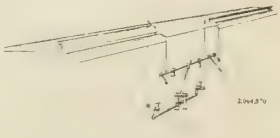
Cylinder fin construction. Ro-




land Chilton, Ridgewood, and Rudolph F. Gagg, Fair Lawn, N. J., assignor to Reed Propeller Co., Inc. (2,064,461)

Column for sky writing. John T. Remey, New York, N. Y. (2,065,024)

Wing structure for aircraft.



Claude Dornier, Friedrichshafen-on-the-Boden-see, Germany, assignor to Dornier-Metallbauten G. m.b.H. (2,064,970)




# WRIGHT CYCLONES *have flown* 60,000,000 *Engine Miles in 5 years* *on* AMERICAN AIRLINES

American Airlines is the first air transportation system in the world to carry 1,000,000 passengers. Wright Cyclones were the first aircraft engines, in the high power class, to complete 1,000,000 hours of operating experience on the world's leading airlines.

Wright is proud of American Airlines' leadership in being the first airline in the world to carry one million passengers. Wright is especially proud of the fact that this one millionth passenger achievement was attained with airplanes powered by Wright Cyclones.

Wright Cyclones are used exclusively to power all of the high-speed Douglas DC-2 and the new Douglas "Flagship" Club (DC-3) and "Flagship" Sleeper (DST) planes of American Airlines. During the past 5 years alone, Cyclones have flown 60,000,000 engine miles on American Airlines' great nation-wide system.

The giant new American Airlines' Douglas Sleeper and Club "Flagships" are each powered by two 1000 horsepower Wright Cyclones—the most powerful aircraft engines in airline operation. The dependable performance of this type of engine is backed by more than 165,000,000 engine miles of operating experience on leading airlines throughout the world.

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# Digest of Technical Articles from Foreign Publications

## Aerodynamics

*The Rolling Up of the Surface of Discontinuity Behind an Aerofoil of Finite Span. F. L. Westwater. Communicated by Dr. S. Goldstein, Air Ministry (Great Britain). Aeronautical Research Committee, Reports and Memoranda No. 1692, August 22, 1935.*

Existence of a surface of discontinuity or vortex sheet behind an airfoil of finite span is well known. The sheet behind an airfoil may be regarded as semi-finite, terminated by the bound vortex which in theory replaces the actual airfoil. As a first approximation the author ignores the bound vortex and treats the trailing vortices as infinite in both directions, so that the problem becomes two-dimensional.

This assumption cannot represent conditions in the immediate neighborhood of the airfoil, but for points at some distance behind the trailing edge the errors involved will be small. A discussion of the errors is given.

In the numerical solution the sheet is replaced by 20 line vortices arranged in 2 groups of 10 symmetrically about the mid-point of the sheet. The velocity components of each vortex were calculated separately, and multiplied by a suitable time factor to give displacements in that time along the tangent to the path at the instant for which the velocity was calculated.

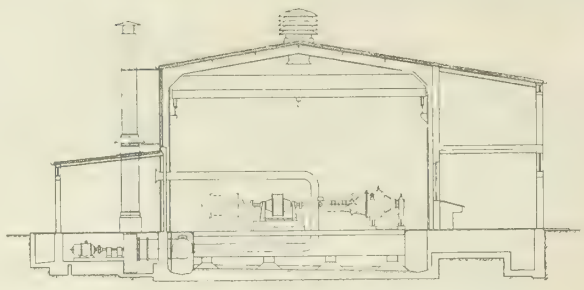
By drawing a smooth curve through the points occupied by vortices we get some idea of the form of the continuous sheet at the corresponding instant. In Kaden's solution, the form of the sheet at any time is a spiral whose asymptote is the original trace of the sheet. In the present case there seems no reason to doubt that the form of the sheet near the edges is also spiral.

## Helicopters

*Modern Helicopter Theory—A Complete Exposition of Up-to-Date Ideas on the Principles of Direct Lift Flight; Vittorio Isacco, Aircraft Engineering, No. 92 and 93; October and November, 1936.*

After a brief introduction the author takes up the theory of direct lift flight discussing sustentation, vertical ascent and ceiling, vertical descent and autorotation and horizontal translation. Not the least interesting is the critical revue of past efforts in helicopter development to which the author devotes the second part of his article. He revues Pescara helicopters, Bothezat, Oemichen, Florine, Ascanio, Asboth, Berliner, Breguet-Dorand, New Asboth, Brennan, and finally his latest development.

The theory appears to be drastically simplified but, given sufficient experimental data, proper corrections can be readily applied. In this case, however, the data is limited and hence it is difficult to estimate without laborious investigation the degree of approximation afforded by this method. The vital question of helicopter stability also should have been given greater prominence in the theoretical discussion. The material, however, is well presented, profusely illustrated and, in view of comparative scarcity of helicopter articles, is particularly interesting.



*The DVL engine test stand and exhaust installation*

## Hydrodynamics

*Flow of Fluids in the Vicinity of Obstacles (L'Ecoulement des Fluides an Voisinage des Points Singuliers des Obstacles; Dr. Louis Sackmann; publications Scientifiques et Techniques du Ministere de L'Air; No. 92, 1936)*

The purpose of the tests conducted by the author was to study in detail flow behavior near an obstacle and to verify to what extent the observed results are in agreement with the theoretical solutions of classical hydrodynamics. Interesting is the descriptions of the experimental equipment used, including three types of experimental units. (1) tunnel of variable cross section, (2) tunnel with free surface and (3) apparatus producing reversible flow of a thin fluid film. The first tunnel had a special provision for varying the thickness of the fluid vein from about 1" to that of exceptionally thin film comparable to the one obtainable with the third apparatus. The records and means of flow visualization consisted of a continuous motion picture record, means of emission of colored substance, and lighting equipment. Studies reported include regions of stagnation, flow separation and turbulent regions. In addition to the experimental observation the paper gives theoretical studies bearing relation to the observed phenomena.

## Design

*Recent Progress in the Design of Civil Flying Boats, A. Gouge, B. Sc., F.R. Ae. S., The Royal Aeronautical Society*

The author reviews the trend in British commercial boat design as exemplified by the "Culcutta," "Kent" and "Empire" flying boats. He points out the general tendency toward greater weight, larger size, smaller relative beam, higher wing and power loading, improved power plant and propellers and the use of flaps. It is apparently felt that wing loadings as high as 45 lbs./ft$^2$ may be safely anticipated while keeping take-off time within reasonable limits. The general improvement in streamlining raised the maximum lift drag ratio of the Empire boat to 13 as compared to a value of 10 of the Kent type. This improvement reflects directly on the range of the modern aircraft. The author believes that aerodynamic improvements will dictate the necessity of providing a retractable fairing for the front step and still further stressing care in design of details.

## Engines

*Experimental Study of Combustion in the Injection-type Engines (Etude Expérimentale de la Combustion dans les Moteurs á Injections; R. Duchéne, publication Scientifiques et Techniques du Ministére de L'Air; No. 94, 1936)*

The apparatus used in these experiments is somewhat unusual since, as the author points out, it may be considered as something half way between a bomb and a single-cylinder engine. The explosion chamber is a cylinder without any irregularities and hence observed disturbances during the explosion cannot be ascribed to dissimitry of the chamber. The absence of accessories essential for the operation of a real engine facilitate the observation. These studies were conducted for the purpose of analyzing the fuel oils contemplated for use of aircraft engines.

## Flutter

*Experiments on Wing Flutter (Experimentelle Untersuchungen über Flügel-Schwingungen; H.L. Studer, Mitteilungen aus dem Institut für Aerodynamik, Eidgenössische Technische Hochschule; No. 4/5, Zürich, 1936) Published by A.-G. Gebr. Leemann & Co., Stockerstr. 64, Zürich*

This paper gives an exhaustive account of an exceedingly thorough research on wing flutter conducted at the Aerodynamic Laboratory of the Zürich Technical Institute. In addition to a masterly presentation of the observations and their analysis, the paper contains a comprehensive bibliography on this important subject. The author first reviews the principal former studies of wing flutter and outlines the scope and program of his research. Next the methods used in the experiments are described in detail as well as preliminary tests on the three typical profiles selected for the study. In the analysis of results, the following factors are discussed: influences of the angle of attack, plan form, center of gravity location, location of elastic axis, frequency, torsional frequency, damping, vibration increments, variation of frequency, phase of vibrations. The text is concluded with a general summary of possible application of results obtained to practical problems of design.

## Rotating Wings

*A Study of a New Type of Wind Mill for Large Powers (Studio di un Tipo de Aeromotore per Grandi Potenze; L. Poggi—Alessandri Stringari) Elementary Aerodynamic Theory of Rotating Wing Wind Operated Motor (Teoria Aerodinamica Elementare del Motore a Vento ad Ali Rotanti; L. Poggi) L'Aerotecnica; Volume XVI—N. 10; Ottobre, 1936*

Both articles treat the subject of a new type wind-operated power unit giving the aerodynamic theory underlying the principle as well as constructional features of the invention. The unit consists substantially of a series of vertical wings placed on the periphery of a circle of large diameter. These wings are appropriately braced to form an interconnected assembly which can rotate around an axis passing through the center of the periphery, being guided by suitable rails and wheels. The wings are provided with a stabilizing smaller tail-like surface to assure an automatically variation of the angle of attack and maintaining it at each moment for greatest efficiency. This feature is made possible by the use of an eccentric which is connected to the main wing and is acted upon by a control roller actuated by the smaller stabilizing surface.

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# AIRCRAFT MANUFACTURERS

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Walter J. Friedlander, pres.; H. V. Fetick, vice-pres.; C. S. McKenzie, gen. mgr.; J. C. Welsch, sales mgr.; R. E. Schlemmer, chief eng. Export representatives: Aeronautical Corp. of Great Britain, Ltd., 7 Park Lane, London, England; R. Guimond & W. R. Hansen, Cia. de Aviacion, "Faucett", Lima, Peru Aviation Equip. & Export, Inc., 25 Beaver St., New York, N. Y.

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**Spartan Aircraft Co., Tulsa, Okla.**
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Walter J. Friedlander, pres.; H. V. Fetick, vice-pres.; C. S. McKenzie, gen. mgr.; J. C. Welsch, sales mgr.; R. E. Schlemmer, chief eng. Export representatives: Aeronautical Corp. of Great Britain, Ltd., 7 Park Lane, London, England; R. Guimond & W. R. Hansen, Cia. de Aviacion, "Faucett", Lima, Peru; Aviation Equip. & Export, Inc., 25 Beaver St., New York.

**Allison Engineering Company, Division of General Motors Corp., Indianapolis, Indiana**
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**Arrow Aircraft Corporation, Lincoln, Nebraska**
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**Jacobs Aircraft Engine Co., Pottstown, Pennsylvania**
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**Kinner Airplane & Motor Corp., Ltd., Glendale, California**
Robert Porter, pres. & gen. mgr.; B. L. Graves, vice-pres.; R. D. Bayly, sec.-treas.; Jos. W. Harper, sales mgr.; Chas. P. Sander, chief eng.; Victor E. Semrau, exp. mgr. & asst. sec.-treas.

**Monocoupe Corporation, Robertson, Missouri (Lambert engines)**
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**LeBlond Aircraft Engine Corp., Cincinnati, Ohio**
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**Aviation Manufacturing Corp., Lycoming Division, Williamsport, Pennsylvania**
L. B. Manning, pres.; Charles F. Barndt, vice-pres. & gen. mgr.; John E. Dunbar, asst. gen. mgr.; George J. Brew, sales mgr.; Val Cronstedt, chief eng.; A. A. Andrake, prod. eng.

**Menasco Manufacturing Co. Los Angeles, California**
A. S. Menasco, pres. & gen. mgr.; Wm. Keith Scott, vice-pres.; Fred Hattoom, sales mgr.; H. G. Townsend, chief eng.; B. F. Irwin, exp. mgr.

**Pratt & Whitney Aircraft Division United Aircraft Corporation East Hartford, Connecticut**
C. W. Deeds, gen. mgr.; L. S. Hobbs, engr. mgr.; A. V. D. Willgoos, chief eng.; T. E. Tillinghast, sales mgr. Export representative: United Aircraft Exports Corp., E. Hartford, Conn.

**Ranger Engineering Corporation, Farmingdale, L. I., New York**
Sherman M. Fairchild, pres.; Walter F. Davis, vice-pres. & gen. mgr.; E. Robinson, exp. mgr.

**Security Aircraft Corp., Glendale, California**
W. B. Kinner, pres. & gen. mgr.; H. Park Arnold, vice-pres.; Hugh H. Green, sales mgr.

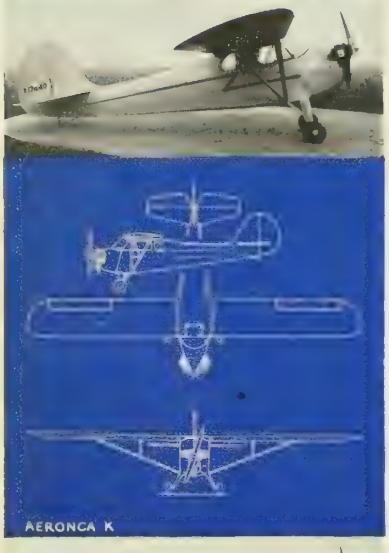
**Warner Aircraft Corp., Detroit, Michigan**
W. O. Warner, pres. & gen. mgr.; Ralph R. Irwin, vice-pres.; L. A. Faunce, vice-pres., sales & exp. mgr.; L. A. Majneri, chief eng.; W. J. Jarvie, sec.-treas.

**Welch Aircraft Industries, South Bend, Indiana**
Orin Welch, pres. & chief eng.; F. W. Bower, sales mgr.

**Wright Aeronautical Corp., Paterson, New Jersey**
Guy W. Vaughan, pres.; Myron B. Gordon, vice-pres. & gen. mgr.; George Chapline, vice-pres. of sales; Philip B. Taylor, chief eng.; Arthur Nutt, vice-pres. of eng. Export representative: Curtiss-Wright Export Corp., N. Y.

# Private and Commercial Airplanes

**The following pages contain a descriptive technical digest of American private and commercial aircraft. Miniature blueprints are shown for 77 basic models of commercial airplanes, and data is included on variations of several types. They indicate what the American aircraft industry has to offer the private flyer and commercial operator not only in the United States, but also in many foreign countries.**




## AERONCA Model K

2-place

*ATC

*ATC pending.

**Specifications.** Span 36′ (11 m.). Length 20′7″ (6.3 m.). Height 6′7″ (2 m.). Wing area 146.35 ft.² (13.6 m.²). Power loading 23.1 lbs./h.p. (10.5 kg./h.p.). Wing loading 7.79 lbs./ft.² (38. kg./m.²). Weight empty 590 lbs. (267.6 kg.). Useful load 450 lbs. (204.1 kg.). Payload 214 lbs. (97.1 kg.). Gross weight 1040 lbs. (471.7 kg.) Baggage 44 lbs. (20 kg.). Fuel 10 gals. (37.8 lit.). Oil .75 gal. (2.8 lit.).

**Engine.** Aeronca E-113C, 40 h.p. at 2500 r.p.m.

**Performance.** Maximum speed 93 m.p.h. (149.7 k.p.h.). Cruising speed 85 m.p.h. (136.8 k.p.h.). Landing speed 35 m.p.h. (56.3 k.p.h.). Service ceiling 12,000 ft. (609.6 m.). Climb per min. 450 ft. (137.2 m.). Cruising range 250 mi. (402.3 km.).

**Construction.** Fuselage: welded chrome molybdenum steel tubing, wood fairing; fabric covered and doped; integral engine mount; four longeron cabin and three longerons to rear; fin integral with fuselage; side-by-side seating arrangement; dual wheel controls of the inset panel type, operating through instrument board; large door on right side; cabin windows can be lowered; overhead window. Wing: solid spruce spars single drag truss type; spruce truss ribs with fibre gussets; fabric covered and doped; aluminum leading edge; Clark Y airfoil section; ailerons Frieze type, metal internal structure, fabric covered; strut bracing by Vee streamlined struts to fuselage. Tail group: welded steel tubing, fabric covered and doped; tab on left elevator for trimming. Fixed single strut landing gear.

**Standard equipment.** Goodyear tires and wheels, Aeronca oleo shock absorbers, Flash fire extinguisher, Bauer & Black first aid equipment, Blocksom Paratex pad cushions, duPont Pyralin windshield and cabin enclosure, Shakespeare throttle controls.

**Instruments.** Aeromarine altimeter, oil pressure gauge, oil temperature gauge, tachometer; Johnson strut-type airspeed indicator, and Aeromarine indicator on panel.




## AERONCA Model LC

2-place

ATC 614

**Specifications.** Span 36′ (11 m.). Length 22′3.5″ (6.8 m.). Height 7′ (2.1 m.). Wing area 150 ft.² (13.9 m.²). Power loading 18.66 lbs./h.p. (8.5 kg./h.p.). Wing loading 11.2 lbs./ft.² (54.7 kg./m.²). Weight empty 1034 lbs. (469 kg.). Useful load 646 lbs. (293.1 kg.). Payload 285 lbs. (129.3 kg.). Gross weight 1680 lbs. (762.1 kg.). Baggage 115 lbs. (52.2 kg.). Fuel 28 gals. (106 lit.). Oil 3 gals. (11.3 lit.).

**Engine.** Warner Scarab Junior, 90 h.p. at 2025 r.p.m.

**Performance.** Maximum speed 123 m.p.h. (197.9 k.p.h.). Cruising speed 108 m.p.h. (181.9 k.p.h.). Landing speed with flaps 42 m.p.h. (67.6 k.p.h.); without flaps 48 m.p.h. (77.2 k.p.h.). Service ceiling 16,500 ft. (5029.2 m.). Climb per min. 650 ft. (198.1 m.). Cruising range 535 mi. (861 km.).

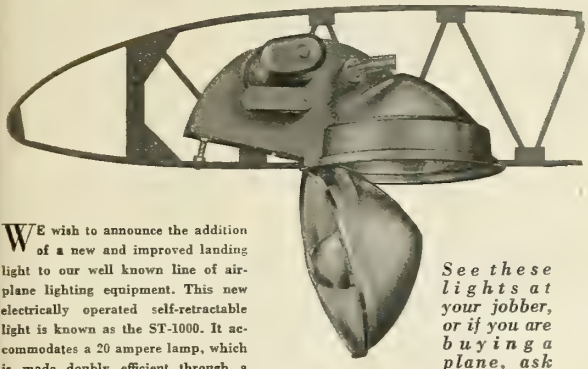
**Construction.** Fuselage: welded steel tubing, wood fairing, fabric covered; separate engine mount; four longeron cabin and three longerons to rear; fin integral with fuselage; side-by-side seating; dual wheel controls. Wing: center section, box spars, double drag wire truss; spruce ribs, truss type; fabric covered; tip section identical to center section except that solid spruce spars are used; metal aileron frame, fabric covered. Manually operated flaps directly under cabin. Tail group: welded steel tubing; fabric covered; tab on left elevator for trimming. Fixed individual type landing gear. Fully swivelling tail wheel. Licensed as a seaplane by the Dept. of Commerce on Edo model 1965 floats.

**Standard equipment.** Sensenich wood propeller, Goodyear tires and wheels and brakes, dual oleo shock absorbers, Shakespeare throttle controls, Pyrene fire extinguisher, Bauer & Black first aid equipment, Blocksom Paratex upholstery, Pyralin windshield and cabin enclosure, Seapak insulation rear of engine firewall.

**Instruments.** Aeromarine, altimeter, oil pressure and oil temperature gauges, tachometer, airspeed indicator, compass.

*Other data in Jan., 1936,* AERO DIGEST.

# A *new* GRIMES Landing Light



WE wish to announce the addition of a new and improved landing light to our well known line of airplane lighting equipment. This new electrically operated self-retractable light is known as the ST-1000. It accommodates a 20 ampere lamp, which is made doubly efficient through a specially designed two-piece reflector. This light throws a beam of 575,000 candle intensity, or about four times as much light as our ST-250 15 ampere light. The retracting mechanism is completely enclosed and all connections are shielded. A new switching arrangement makes it possible to light it at any angle. Weight is less than five pounds per unit.

*See these lights at your jobber, or if you are buying a plane, ask the factory.*

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**URBANA, OHIO**

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***Head designed for installation on standard beacon bases now in service.***



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U. S. Army
State of Rhode Island
Union of Socialist Soviet Republics

*Several Present Installations:*

Newark Airport
Providence, R. I.
Vicksburg, Miss.
McComb, Miss.
Johannesburg, South Africa
Salisbury, South Africa

*U. S. Airway Beacon Sites:*

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Washington, D. C.
San Leandro Hill, Calif.
Weatherford, Texas



No. 12 Bartow Beacon

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**1605 WALNUT STREET**
**PHILADELPHIA PENNA.**

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● Thanks for the enthusiastic reception accorded the new 1937 Aeronca at the New York Show!

● It has become an axiom that every year Aeronca sets the standard for what's newest and best in the light plane field.

● And this year it's miles ahead with a De Luxe High Wing — streamlined from propellor hub to rudder tip • clean, single-strut oleo landing gear • elevator tab control from cabin • spacious cabin, with oceans of head, shoulder and leg room • excellent visibility in all directions • side by side seating • DUAL WHEEL CONTROL • offering more dollar for dollar value in smart looks, sheer comfort, and brilliant performance than ever before. A De Luxe plane, for sport or training, priced within the reach and means of every air enthusiast!

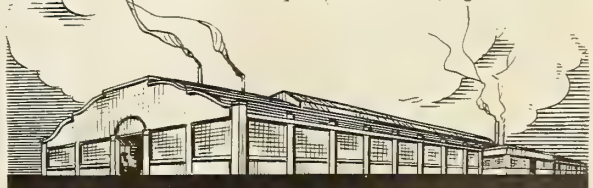
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● Thanks for your solicitous inquiries when Old Man River knocked at our door. Outside of a ten-day inconvenience and the present overtime schedule to make up for lost production, it's just a memory now.

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## AERONEER 1-B

2-place

***ATC**

*ATC pending.

**Specifications.** Span 32′ 6″ (9.9 m.). Length 24′ (7.3 m.). Height 7′ 8″ (2.3 m.). Wing area 168 ft.$^2$ (15.6 m.$^2$). Power loading 17.44 lbs./h.p. (7.9 kg./h.p.). Wing loading 12.97 lbs./ft.$^2$ (5.9 kg./m.$^2$). Weight empty 1475 lbs. (670.5 kg.). Useful load 705 lbs. (320.5 kg.). Payload 230 lbs. (104.5 kg.). Gross weight 2180 lbs. (990.9 kg.). Baggage 40 lbs. (18.2 kg.). Fuel 43 gals. (162.8 lit.). Oil 3.5 gals. (13.3 lit.).

**Engine.** Menasco C-4, 125 h.p. at 2175 r.p.m. at 8000 ft. (2438.4 m.); 1975 r.p.m. for cruising.

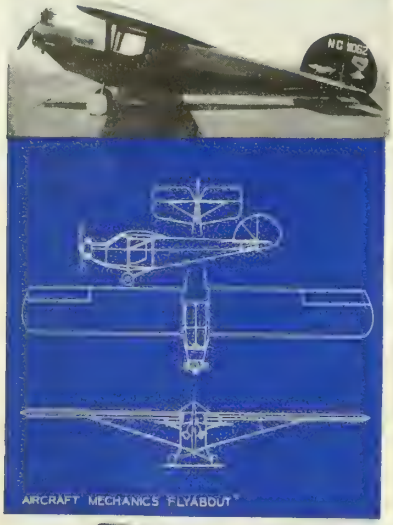
**Performance.** Maximum speed 140 m.p.h. (224 k.p.h.). Cruising speed 130 m.p.h. (208 k.p.h.) at 1975 r.p.m. Landing speed with flaps 49 m.p.h. (78 k.p.h.); without flaps 55 m.p.h. (88 k.p.h.). Service ceiling 15,000 ft. (4562.5 m.). Climb per minute 800 ft. (243.3 m.). Cruising range 720 mi. (1156.1 km.).

**Construction.** Fuselage: all-metal, monocoque; 24S-T Alclad aluminum alloy covering; stiffened skin type; detachable engine mount; side-by-side seating arrangement; sliding Plastecele enclosure; steel fire wall; baggage compartment aft of cabin; dual controls. Wing: all-metal, full cantilever; 24S-T covered; single spar construction with rectangular center section and tapering outer panels semi-detachable leading edge; fuel tanks in wing. Split trailing edge all-metal manually-operated flaps extend from aileron to aileron. Tail group: all-metal, cantilever; stabilizer and fin dural covered; elevators and rudder fabric covered; adjustable trim tabs on elevators; semi-adjustable tab on rudder. Fixed divided type landing gear with each leg enclosed in metal fairings. Swivelling tail wheel with provision for locking in position.

**Standard equipment.** Fixed pitch propeller, 6.50 × 10 General tires, Auto-Fan hydraulic brakes, Reading battery.

**Instruments.** Altimeter, fuel gauge, oil pressure and oil temperature gauges, tachometer, airspeed indicator.

*Other data in Aug., 1936,* AERO DIGEST.




## AIRCRAFT MECHANICS Flyabout

2-place

**ATC 439**

Models D-1 and D-2; data given in that order.

**Specifications.** Span 37′ 9.5″ (11.5 m.). Length 21′ 9″ (6.6 m.); 21′ 7″ (6.6 m.). Height 5′ 8″ (1.7 m.). Wing area 175 ft.$^2$ (16.3 m.$^2$). Wing loading 5.5 lbs./ft.$^2$ (26.9 kg./m.$^2$). 5.6 lbs./ft.$^2$ (27.3 kg./m.$^2$). Weight empty 573 lbs. (259.9 kg.); 590 lbs. (267.6 kg.). Useful load 389 lbs. (176.5 kg.); 392 lbs. (177.8 kg.). Payload 170 lbs. (77.1 kg.); 173 lbs. (78.5 kg.). Gross weight 962 lbs. (436.4 kg.); 982 lbs. (445.4 kg.). Fuel 7 gals. (26.5 lit.). Oil 1 gal. (3.8 lit.); 1.5 gals. (5.7 lit.).

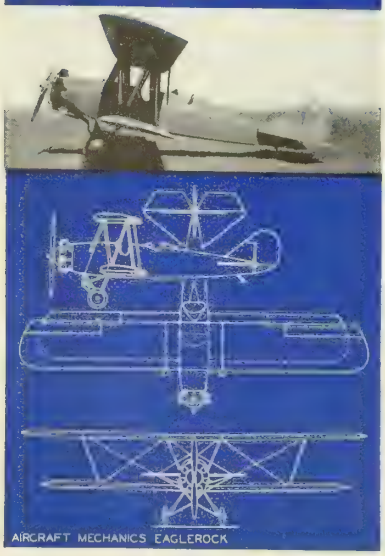
**Engine.** Continental A-40 rated 37 h.p. at 1750 r.p.m.; Szekely SR3-O rated 45 h.p. at 2500 r.p.m.

**Performance.** Maximum speed 80 m.p.h. (128.8 k.p.h.); 93 m.p.h. (149.7 k.p.h.). Cruising speed 72 m.p.h. (115.9 k.p.h.); 77 m.p.h. (123.9 k.p.h.). Landing speed 28 m.p.h. (45.1 k.p.h.); 32 m.p.h. (51.5 k.p.h.). Service ceiling 8500 ft. (2590.8 m.); 13,000 ft. (3962.4 m.). Climb per min. 350 ft. (106.7 m.); 700 ft. (213.4 m.). Cruising range 160 mi. (257.5 km.); 150 mi. (241.4 km.).

**Construction.** Fuselage: Warren truss type, welded steel tubing, fabric-covered; side-by-side seating, dual controls, luggage compartment behind seats; fuel tanks behind fireproof bulkhead. Wing: wood; fabric covered; NACA M-6 section; rigidly-braced, supported above fuselage by system of steel tubular struts; two spruce box spars, I-section ribs. Tail group: steel tubular construction, fabric covered; wire braced; stabilizer adjustable in flight; fixed fin braced from stabilizer by steel tube struts. Fixed divided-type landing gear. Swivelling spring steel tail-skid with hardened steel shoe.

**Standard equipment.** Fahlin wood propeller, Goodyear 16 × 7.3 tires, Goodyear wheels, wiring for navigation lights, cabin heater, large sliding windows, switch, Pyrene fire extinguisher, first aid equipment.

**Instruments.** Tachometer, oil pressure gauge, oil temperature gauge, altimeter, fuel gauge on both models.




## AIRCRAFT MECHANICS Eaglerock

3-place

**Approval 2-103**

**Specifications.** (Model A-14). Span 36′ 8″ (11.2 m.). Length 25′ 7″ (7.8 m.). Height 9′ 10″ (3 m.). Wing area 180 ft.$^2$ (16.7 m.$^2$). Power loading 15.7 lbs./h.p. (7.1 kg./h.p.). Wing loading 7.85 lbs./ft.$^2$ (38.3 kg./m.$^2$). Weight empty 1651 lbs. (749.9 kg.). Useful load 937 lbs. (452 kg.). Payload 340 lbs. (154.2 kg.). Gross weight 2588 lbs. (1191.9 kg.). Fuel 65.5 gals. (247.9 lit.). Oil 5 gals. (18.9 lit.).

**Engine.** Wright Whirlwind J6-5 rated 180 h.p. at 2200 r.p.m.

**Performance.** Maximum speed 123 m.p.h. (198 k.p.h.). Cruising speed 107 m.p.h. (172.2 k.p.h.). Landing speed 38 m.p.h. (61.2 k.p.h.). Service ceiling 16,000 ft. (4876.8 m.). Climb per min. 928 ft. (282.9 m.). Cruising range 500 mi. (804.7 km.).

**Construction.** Fuselage: steel tubing welded, fabric covered; tandem seating, two passengers in front, dual controls. Wings: spruce spars and ribs, fabric covered; metal trailing edge; ailerons are box-beamed and wood-ribbed construction, fabric covered; Clark Y airfoil section. Center section carried on widely-splayed struts, one set of *N* type interplane struts on either side of fuselage. Double drag wires in center section and wings out to interplane struts; single wires to wing tips; ailerons on upper and lower wings interconnected with struts aft of wing struts. Tail group: steel tubing construction, fabric covered; stabilizer adjustable in flight; fin fixed; balanced type rudder; fin wire braced to fuselage. Fixed split type landing gear. Fixed type tail skid.

**Standard equipment.** Hamilton Standard metal propeller, Bendix wheels and brakes, 30 × 5 tires, rubber cord shock absorbers, wiring for navigation lights, fire extinguisher, first aid equipment, baggage compartment, switch, fuel cut-off, left or right throttle with removable handle, streamlined head rest, inspection windows, starter bracket, tie down ropes, cockpit covers.

**Instruments.** Altimeter, fuel, fuel pressure, oil pressure, and oil temperature gauges, tachometer, compass.




*Curtiss SOC-1 Navy Scouting Biplane*

**Houde knows metals — and how to machine them with split-thousandth precision. And, so, for its latest Navy Scouting Biplanes, Curtiss utilized Houde's skill and facilities for the production of many special parts. Similarly, many other manufacturers entrust to Houde metal-working problems calling for exceptional accuracy and faultless workmanship, coupled with lowered costs. If you have such a problem, Houde engineers will gladly discuss it with you.**

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A DIVISION OF HOUDAILLE HERSHEY CORPORATION

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## AIR TRANSPORT B-6 and B-6-S

6-place

*ATC

Models B-6 and B-6-S (seaplane); data given in that order. *ATCs pending.

**Specifications.** Span 48′ 10″ (14.9 m.). Length 33′ (10.1 m.). Height 10′ (3 m.). Wing area 377 ft.² (35 m.²). Power loading 11 lbs./h.p. (4.9 kg./h.p.). Wing loading 14.6 lbs./ft.² (64.5 kg./m.²). Weight empty 3102 lbs. (1407 kg.); 3600 lbs. (1632.9 kg.). Useful load 2398 lbs. (1087.7 kg.). Payload 1448 lbs. (656.8 kg.). Gross weight 5500 lbs. (2494.8 kg.); 5493 lbs. (2491.5 kg.). Baggage 580 lbs. (263.1 kg.). Fuel 120 gals. (454.2 lit.). Oil 9 gals. (34.1 lit.).

**Engine.** Wright Whirlwind R-760-E (two), 250 h.p. at 2000 r.p.m.

**Performance.** Maximum speed 190 m.p.h. (305.8 k.p.h.); 180 m.p.h. (289.8 k.p.h.). Cruising speed 180 m.p.h. (289.8 k.p.h.); 170 m.p.h. (273.6 k.p.h.). Landing speed with flaps 52 m.p.h. (83.7 k.p.h.). Service ceiling 21,000 ft. (6400.8 m.); 20,750 ft. (6324.6 m.). Climb per min. 1230 ft. (374.8 m.); 1200 ft. (365.8 m.). Cruising range 500 mi. (804.7 km.).

**Construction.** Fuselage: welded steel tubing; fabric covered. Wing: Gottengen 398 airfoil section; wood box-beam spars, steel compression members; wood truss type ribs; fabric covered. Split trailing edge type flaps, manually operated. Tail group: welded steel tubing; fabric covered.

**Standard equipment.** Hamilton Standard propellers, Eclipse starter, Goodrich tires (Edo X-A-5400 floats), Autofan wheels and brakes, Cleveland Pneumatic shock absorbers, Exide battery, Fafnir bearings for engine and plane controls, Grimes navigation lights, S & M landing lights, Pyrene fire extinguisher, Dayton lavatory equipment, Seapak insulation, NACA cowls, radio, radio shielding and bonding, Burroughs-Wellcome first aid kit.

**Instruments.** Pioneer altimeter, clock, oil pressure and oil temperature gauges, tachometer, ammeter, compass, airspeed, turn and bank and rate of climb indicators; Kollsman sensitive altimeter, fuel gauge; flap position indicator.






## AIR TRANSPORT P-2

2-place

ATCs 482-488

Models Trainer P-2 and Sportster P-2-S; data given in that order.

**Specifications.** Span 32′ (9.6 m.). Length 24′ (7.3 m.). Height 7′ (2.1 m.). Wing area 163 ft.² (15.1 m.²). Power loading 16.5 lbs./h.p. (7.5 kg./h.p.); 17.50 lbs./h.p. (7.9 kg./h.p.). Wing loading 10.12 lbs./ft.² (49.4 kg./m.²); 10.73 lbs./ft.² (52.4 kg./m.²). Weight empty 1020 lbs. (462.7 kg.); 1075 lbs. (487.6 kg.). Useful load 630 lbs. (285.8 kg.); 675 lbs. (306.2 kg.). Payload 250 lbs. (113.4 kg.); 347 lbs. (157.4 kg.). Gross weight 1650 lbs. (748.5 kg.); 1750 lbs. (793.8 kg.). Baggage 80 lbs. (36.3 kg.); 100 lbs. (45.4 kg.). Fuel 30 gals. (113.6 lit.). Oil 3 gals. (11.4 lit.).

**Engine.** Kinner K-5, 100 h.p. at 1810 r.p.m.

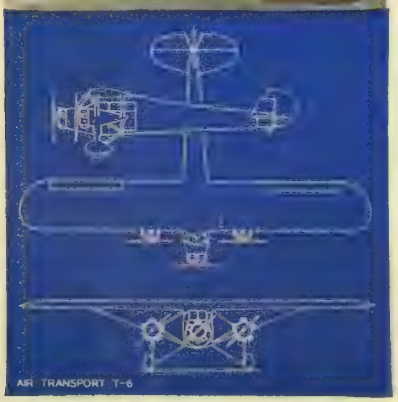
**Performance.** Maximum speed 130 m.p.h. (209.2 k.p.h.); 135 m.p.h. (217.3 k.p.h.). Cruising speed 105 m.p.h. (169 k.p.h.); 110 m.p.h. (177 k.p.h.). Landing speed 40 m.p.h. (64.4 k.p.h.). Service ceiling 14,000 ft. (4267.2 m.). Climb per min. 1200 ft. (365.8 m.). Cruising range 450 mi. (724.2 km.).

**Construction.** Fuselage: truss type welded steel tubing; wood fairing, fabric covered; tandem seating arrangement with dual controls. Wing: Gottengen 398 airfoil section; strut braced parasol monoplane type with strut-braced cabin; wood construction; box beam spars; steel compression members; wood truss ribs; fabric covered. Tail group: welded steel tubing; fabric covered. Fully swivelling tail wheel. Fixed landing gear.

**Standard equipment.** Hamilton Standard propeller, Goodrich 20 × 9.4 balloon tires, 6 × 2.5 tail wheel tire, Autofan wheels and brakes, Goodrich shock absorbers, Fafnir bearings for engine and plane controls, Grimes model B navigation lights, Pyrene fire extinguisher, duPont Fiberloid windshield, Burroughs-Wellcome first aid equipment.

**Instruments.** Pioneer type 355-C altimeter, type 505-B oil pressure gauge, type 354 airspeed indicator, type 506-B oil temperature gauge, type 651 turn and bank indicator, type 734 tachometer, type 718-B compass.






## AIR TRANSPORT T-6

5 passengers—1 pilot

ATC 223

**Specifications.** Span 48′ 10″ (14.9 m.). Length 33′ 6″ (10.2 m.). Height 9′ 6″ (2.9 m.). Wing area 315 ft.² (29.3 m.²). Power loading 15 lbs./h.p. (6.8 kg./h.p.). Wing loading 14.3 lbs./ft.² (69.8 kg./m.²). Weight empty 2828 lbs. (1282.8 kg.). Useful load 1672 lbs. (758.4 kg.). Payload 936 lbs. (424.6 kg.). Gross weight 4500 lbs. (2041.2 kg.). Baggage 100 lbs. (45.4 kg.). Fuel 85 gals. (321.7 lit.). Oil 9 gals. (34.1 lit.).

**Engine.** Kinner K-5 (three), 100 h.p. at 1810 r.p.m.

**Performance.** Maximum speed 140 m.p.h. (225.3 k.p.h.). Cruising speed 120 m.p.h. (193.1 k.p.h.) at 1810 r.p.m. Landing speed 47 m.p.h. (75.6 k.p.h.). Service ceiling 18,000 ft. (5486.4 m.). Climb per min. 1100 ft. (335.3 m.). Cruising range 450 mi. (724.2 km.).

**Construction.** Fuselage: welded steel tubing; fabric covered. Wing: Gottengen 398 airfoil section; wood, box beam spars, wood truss ribs; fabric covered. Tail group: welded steel tubing; fabric covered. Fully swivelling tail wheel.

**Standard equipment.** Goodrich 9.50 × 12 semi-balloon tires; Goodrich 5.00 × 4 tail wheel tire, Hamilton Standard propellers, Eclipse starter, Autofan wheels and brakes, Cleveland Pneumatic oleo shock absorbers, Exide battery, Fafnir engine and plane control bearings, Grimes model B navigation lights, National Steel Products model B-5 throttle controls, Pyrene fire extinguisher, Pittsburgh Plate Duplate windshield and cabin enclosure, Dayton lavatory equipment, Seapak insulation, Burroughs-Wellcome first aid equipment, dual controls, wheel fairings.

**Instruments.** Pioneer altimeter type 355-C, clock type 543-H, airspeed indicator type 354, oil pressure gauge type 505-B, turn and bank indicator type 385-B, oil temperature gauge type 506-B, rate of climb indicator type 374-B, tachometer type 347, compass type 780; Western ammeter type 3606; fuel gauge. Provision also made for sensitive altimeter, air temperature gauge, and thermocouples.



# CLEAR SPANS




ove—New assembly plant Boeing Aircraft Co., ttle; 200 ft. clear span; 35 ft. overhead clearance. signed and built by Austin. Below—Modern air nsport hangar design by Austin.

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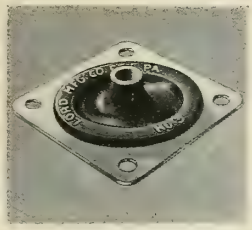
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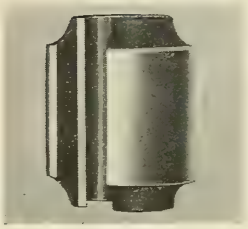
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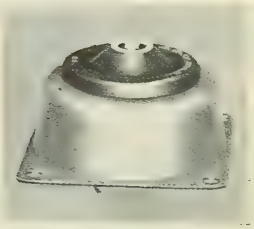
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## ARGONAUT Pirate

3-place

***ATC**

*ATC pending.

**Specifications.** Span 42 feet (12.8 meters). Length 27 feet 1 inch (8.2 meters). Height 10 feet 3 inches (3.1 meters). Wing area 224.75 square feet (20.9 square meters). Power loading 18 pounds per horsepower (8.2 kilograms per horsepower). Wing loading 11.25 pounds per square foot (54.9 kilograms per square meter). Weight empty 1600 pounds (725.8 kilograms). Useful load 650 pounds (294.8 kilograms). Payload 510 pounds (231.3 kilograms). Gross weight 2250 pounds (1020 kilograms). Baggage 170 pounds (77.1 kilograms). Fuel 40 gals. (151.4 lits). Oil 3 gals. (11.3 lit).

**Engine.** Menasco Pirate C-4, 125 h.p. at 2175 r.p.m.

**Performance.** Maximum speed 100 miles per hour (160.9 kilometers per hour). Cruising speed 90 miles per hour (144.8 kilometers per hour). Landing speed 55 miles per hour (88.5 kilometers per hour). Service ceiling 10,500 ft. (3200 m.). Climb per min. 550 ft. (167.6 m.). Range 375 mi. (603.5 km.).

**Construction.** Amphibion. Hull: semi-monocoque; spruce stringers connecting 7-ply aircraft plywood diaphragms; plywood and fabric covered. Wing: rectangular solid spruce, fabric covered; Clark Y airfoil section; spruce built-up ribs; rectangular spruce spars. Tail group: chrome molybdenum tubing; fabric covered. Fully retractable landing gear, manually operated.

**Standard equipment.** Hartzell or Sensenich wood propeller, Goodyear 19 × 9 × 3 tires and wheels, Goodyear mechanical brakes, Rusco shock cord absorption, Exide battery, Formica pulleys for engine and plane controls, Grimes navigation lights, Pyrene fire extinguisher, Johnson & Johnson first aid kit, Johnson & Faulkner upholstery, Plexiglas cabin enclosure, Eclipse starter, Shakespeare throttle controls, Northill anchor, Goodyear 8″ streamline tail wheel tire.

**Instruments.** Kollsman altimeter, fuel pressure gauge, oil pressure gauge, oil temperature gauge, tachometer, airspeed indicator, compass; Pioneer fuel gauge.






## ARROW Sport Model F

2-place

**ATC 613**

**Specifications.** Span 36′ 7″ (11.1 m.). Length 21′ 4″ (6.5 m.). Height 8′ 10″ (2.7 m.). Wing area 180 ft.² (16.6 m.²). Power loading 20 4 lbs./h.p. (9.3 kg./h.p.). Wing loading 9.3 lbs./ft.² (45.5 kg./m.²). Weight empty 1172 lbs. (531.6 kg.). Useful load 503 lbs. (228.2 kg.). Payload 198 lbs (89 kg.). Gross weight 1675 lbs. (761 kg.). Baggage 28 lbs. (13 kg.). Fuel 20 gals. (75.7 lit.). Oil 2 gals. (7.6 lit.).

**Engine.** Arrow F, converted Ford V-8, 82 h.p. at 3075 r.p.m.

**Performance.** Maximum speed 100 m.p.h. (160.9 k.p.h.). Cruising speed 95 m.p.h. (152.9 k.p.h.) at 80 h.p. (2900 r.p.m.). Landing speed 45 m.p.h. (72.4 k.p.h.). Service ceiling 12,000 ft. (3657.6 m.). Climb per min. 800 ft. (243.8 m.). Cruising range 300 mi. (482.8 km.).

**Construction.** Fuselage: welded steel tubing; fabric covered; side-by-side seating arrangement with wheel-type dual controls; baggage compartment aft of seat; canopy top. Wing: rectangular low-wing type; externally braced with chrome steel struts Vee type; NACA 2212 airfoil section; solid spruce spars, spruce and plywood truss ribs; fabric covered. Tail group: welded steel tubing; fabric covered; wire and strut braced. Fixed divided type landing gear. Leaf-spring tail skid.

**Standard equipment.** Fahlin wood propeller, Goodrich 7.00 × 5 low pressure tires, Hayes wheels, Goodrich rubber cord shock absorbers, Willard battery, Pyrene fire extinguisher, Bauer & Black first aid equipment, imitation leather upholstery, Pyralin windshield. Special equipment: hand operated starter, Goodyear solid rubber tail wheel tire, Bendix mechanical brakes, and Grimes navigation lights.

**Instruments.** Pioneer C-101 altimeter, type C-104 oil pressure gauge, type C-100 airspeed indicator, type C-105 water temperature gauge; Ford float-type fuel gauge, ammeter; US Gauge type 10 fuel pressure gauge; Aeromarine type 51 compass; Nicholas Beazley type C-14-C compression type throttle controls; Waltham tachometer.

PHOTOGRAPH
NOT AVAILABLE




## BARKLEY-GROW T8P-1

8-place

**EXP**

**Specifications.** Span 50′ 8.75″ (15.5 m.). Length 35′ 8″ (10.9 m.). Height 9′ 7.5″ (3 m.). Wing area 354 ft.² (32.9 m.²). Power loading 10 lbs./h.p. (4.5 kg./h.p.). Wing loading 26.3 lbs./ft.² (128.4 kg./m.²). Weight empty 5365 lbs. (2433.6 kg.). Useful load 2585 lbs. (1172.5 kg.). Payload 1450 lbs. (657.7 kg.). Gross weight 7950 lbs. (3606.1 kg.). Baggage 430 lbs. (195 kg.). Fuel 120-160 gals. (454.2-605.7 lit.). Oil 10-14 gals. (37.8-53 lit.).

**Engines.** P & W Wasp Jr., SB, (two), 400 h.p. at 2200 r.p.m. at 5000 ft. (1524 m.).

**Performance.** (Estimated) Maximum speed at 5000 ft. (1524 m.) 226 m.p.h. (363.7 k.p.h.). Cruising speed at 11,400 ft. (3354.7 m.) at 65% power 204 m.p.h. (328.2 k.p.h.). Landing speed with flaps 64.3 m.p.h. (103.5 k.p.h.). Service ceiling 27,000 ft. (8229.6 m.). Climb per min. 1710 ft. (521.2 m.). Cruising range 810 mi. (1303.6 km.).

**Construction.** Fuselage: semi-monocoque with I and bulb-section 24S-T frame and bulb section stringers; 24S-T Alclad skin. Wing: 24S-T Alclad skin; 24S-T spars; no ribs. Flaps split and slotted. Tail group: full cantilever; multi-spar stabilizer; dual vertical surfaces; one-piece elevator. Fixed type landing gear (retractable type can be supplied upon special order).

**Standard equipment.** Hamilton Standard constant speed propellers, Goodyear tires, wheels and hydraulic brakes, Cleveland Aerol shock absorbers, Exide battery, Gries navigation lights, Adams & Westlake landing lights, Kidde fire extinguisher, International flares, Seapak insulation, RCA two-way radio, Eclipse starter.

**Instruments.** Kollsman altimeters (2), engine gauge unit, manifold pressure gauge, airspeed indicator, compass, vertical speed indicator; Pioneer turn and bank indicator; Weston thermocouple, tachometer, ammeter, carburetor temperature gauge; cabin temperature gauge; Sperry directional gyro, gyro-horizon; MotoMeter air temperature and fuel gauges, flap position indicator; Cambridge fuel-air ratio indicator.

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**Engine**
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## BEECH Beechcraft Model 18

8-place

***ATC**



*ATC pending.

Models 18A and 18B; data in that order.

**Specifications.** Span 47'8" (14.5 m.). Length 31'11" (9.7 m.). Height 9'5" (2.9 m.). Wing area 347 ft.$^2$ (32.2 m.$^2$). Power loading 9.39 lbs./h.p. (4.2 kg./h.p.); 10.83 lbs./h.p. (4.9 kg./h.p.) Wing loading 18.7 lbs./ft.$^2$ (91.3 kg./m.$^2$). Weight empty 4100 lbs. (1859.8 kg.); 3920 lbs. (1778.1 kg.). Useful load 2400 lbs. (1088.6 kg.); 2580 lbs. (1170.3 kg.). Gross weight 6500 lbs. (2948.4 kg.). Baggage 250 lbs. (127 kg.). Fuel (standard) 160 gals. (605.7 lit.); (optional) 210 gals. (796.9 lit.). Oil 13 gals. (49.2 lit.).

**Engines.** Wright Whirlwind R760E-2 (two), 320 h.p. at 2150 r.p.m.; Jacobs L5 (two), 285 h.p. at 2000 r.p.m.

**Performance.** Cruising speed 192 m.p.h. (309 k.p.h.) at 10,000 ft. (3048 m.); 190 m.p.h. (305.8 k.p.h.) at 8000 ft. (2438.4 m.). Landing speed with flaps 50 m.p.h. (80.5 k.p.h.). Service ceiling 20,000 ft. (6096 m.); 19,000 ft. (5791.2 m.). Climb per min. 1250 ft. (381 m.); 1200 ft. (365.7 m.). Cruising range (maximum) 1070 mi. (1722.1 km.).

**Construction.** All-metal, monocoque; aluminum alloy covered. Wing: steel and aluminum alloy spars; aluminum alloy ribs, truss type; aluminum alloy covered. Flaps trailing edge type, aluminum alloy truss type ribs; fabric covered. Tail group: all-metal, aluminum alloy; rudders and elevators fabric covered; stabilizer and fin, aluminum alloy covered. Retractable landing gear.

**Standard equipment.** Hamilton Standard controllable-pitch propellers (Curtiss-Reed), Goodyear tires and wheels, Hayes brakes, Exide battery, Fafnir and Schatz bearings for controls, Pittsburgh safety glass, Eclipse starter, Lear transmitter and receiver.

**Instruments.** Pioneer altimeter, compass manifold pressure gauge, clock, fuel pressure, oil pressure and oil temperature gauges, tachometer, airspeed, turn and bank, and rate of climb indicators; Weston air temperature, head temperature gauges, selector switch; Moto Meter ammeter; Air Associates wheel position lights.



## BEECH Beechcraft C17R

5-place

**ATC 604**



**Specifications.** Span 32' (9.7 m.). Length 24'8.25" (7.5 m.). Height 8'1" (2.5 m.). Wing area 265.7 ft.$^2$ (24.7 m.$^2$). Power loading 12 lbs./h.p. (3.6 kg./h.p.). Wing loading 14.7 lbs./ft.$^2$ (71.8 kg./m.$^2$). Weight empty 2200 lbs. (997.9 kg.). Useful load 1700 lbs. (771.3 kg.). Variable payload. Gross weight 3900 lbs. (1769.2 kg.). Baggage 125 lbs. (56.7 kg.). Fuel 98 gals. (371 lit.). Oil 6 gals. (22.7 lit.)

**Engine.** Wright Whirlwind R975E-3, 420 h.p. at 2200 r.p.m. at 1400 ft. (426.7 m.).

**Performance.** Maximum speed 211 m.p.h. (339.6 k.p.h.). Cruising speed 202 m.p.h. (304.8 k.p.h.) at 9000 ft. (2743.2 m.). Landing speed with flaps 50 m.p.h. (80.5 k.p.h.). Service ceiling 22,000 ft. (6705 m.). Climb per min. 1500 ft. (475.2 m.). Variable cruising range.

**Construction.** Fuselage: 4130 chrome molybdenum steel tubing, welded; fabric covered. Wings: NACA CYH airfoil section; elliptical, dihedral wing tips; solid spruce spars; spruce truss type ribs; fabric covered. Flaps on underside of upper wing; metal construction; manually operated. Tail group: 4130 chrome molybdenum steel and spruce; strut braced; fabric covered. Fully retractable landing gear, manually or electrically operated. Retractable and swivelling tail wheel. Licensed as seaplane.

**Standard equipment.** Hamilton Standard propeller, General or Goodrich tires, Hayes wheels and mechanical brakes, Exide battery, Fafnir and Schatz ball bearings for controls, Grimes navigation lights, Chase mohair, Eagle Ottawa leather and Laidlaw broadcloth, Pittsburgh safety glass, Seapak insulation, Eclipse starter and generator, Romec fuel and wobble pumps, Johnson & Johnson first aid equipment, shielding and bonding.

**Instruments.** Pioneer altimeter, manifold pressure gauge, clock, engine gauge unit, tachometer, airspeed, turn and bank and rate of climb indicators, compass; Weston head temperature gauge; Moto Meter ammeter; Air Associates fuel warning unit and wheel position lights; fuel gauge.



## BEECH Beechcraft C17L and C17B

5-place

**ATC 602**



Models C17L and CI7B; data given in that order.

**Specifications.** Span 32' (9.7 m.). Length 24'9.5" (7.6 m.); 26'.5" (7.9 m.). Height 8'6" (2.6 m.); 8' (2.4 m.). Wing area 273 ft.$^2$ (25.4 m.$^2$); 265.7 ft.$^2$ (24.7 m.$^2$). Power loading 14 lbs./h.p. (7.35 kg./h.p.); 11.75 lbs./h.p. (5.4 kg./h.p.). Wing loading 11.5 lbs./ft.$^2$ (56.1 kg./m.$^2$); 12.6 lbs./ft.$^2$ (61.5 kg./m.$^2$). Weight empty 1825 lbs. (827.8 kg.); 2053 lbs. (931.2 kg.). Useful load 1325 lbs. (601 kg.); 1097 lbs. (497.6 kg.). Gross weight 3150 lbs. (1428.8 kg.). Baggage 125 lbs. (56.7 kg.). Fuel 46 gals. (174.1 lit.); 74 gals. (280.1 lit.). Oil 5 gals. (18.9 lit.).

**Engine.** Jacobs L4, 225 h.p. at 2000 r.p.m.; Jacobs L5, 285 h.p. at 2000 r.p.m.

**Performance.** Maximum speed 175 m.p.h. (281.6 k.p.h.); 185 m.p.h. (297.7 k.p.h.). Cruising speed (at 7000 ft; 2194.6 m.) 166 m.p.h. (267.2 k.p.h.); 177 m.p.h. (284.9 k.p.h.). Landing speed with flaps 45 m.p.h. (72.4 k.p.h.). Service ceiling 15,000 ft. (4572 m.); 18,000 ft. (5486.4 m.). Climb per min. 1000 ft. (304.8 m). Cruising range 500-800 mi. (804.7-1287.5 km.); 700 mi. (1127 km.).

**Construction.** Fuselage: 4130 chrome molybdenum steel tubing, welded; fabric covered. Wings: NACA CYH airfoil section; elliptical, dihedral wing tips; solid spruce spars; spruce truss type ribs; fabric covered. Flaps trailing edge type; spruce, fabric covered. Tail group: 4130 chrome molybdenum steel tubing and spruce; full cantilever; fabric covered. Retractable landing gear. Licensed as seaplane on Edo floats.

**Standard equipment.** Hartzell wood propeller; Curtiss metal propeller; General or Goodrich tires, Hayes wheels and mechanical brakes, Exide battery, Grimes navigation lights, Seapak insulation, Eclipse starter and generator, Romec wobble pump.

**Instruments.** Pioneer altimeter, oil pressure, oil temperature gauges, tachometer, airspeed, turn and bank, rate of climb indicators, compass; Air Associates wheel position lights; Moto Meter ammeter; fuel gauge.






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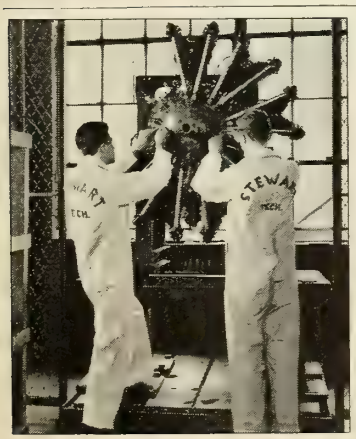
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## BELLANCA Flash 28-70

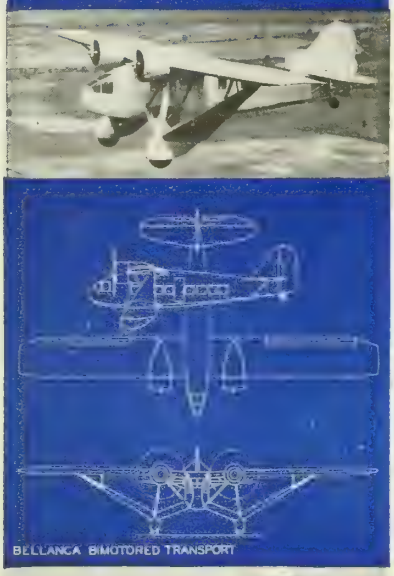
2-place **RESTRICTED**




**Specifications.** Span 46′2″ (14.05 m.). Length 26′ (7.96 m.). Height 7′ (2.13 m.). Wing area 279 ft.² (25.92 m.²). Power loading 11.9 lbs./h.p. (5.4 kg./h.p.). Wing loading 29 lbs./ft.² (141.6 kg./m.²). Weight empty 4074 lbs. (1849.6 kg.). Useful load 4276 lbs. (1941.3 kg.). Gross weight 8350 lbs. (3790.9 kg.). Fuel 600 gals. (2271 lit.). Oil 44 gals. (166.34 lit.).
**Engine.** P & W SAG Twin-row Wasp Junior, 700 h.p. at 2500 r.p.m. at 9000 ft. (2743.2 m.).
**Performance.** Maximum speed 275 m.p.h. (442.75 k.p.h.). Cruising speed 240 m.p.h. (386.4 k.p.h.). Landing speed 68 m.p.h. (109.5 k.p.h.). Service ceiling 26,000 ft. (7924.8 m.). Climb per min. 1500 ft. (467.2 m.). Cruising range 4000 mi. (6440 km.).
**Construction.** Fuselage: chrome molybdenum steel tubing; fabric covered; tandem seating arrangement with dual controls; sliding canopy top: fuel tanks forward of cockpit. Wing: wood spars; wood ribs; fabric covered; braced externally by streamlined tie rods extending to fuselage on top and to two steel supporting struts extending below. Tail group: stabilizer and fin, wood structure, fabric and plywood covered; elevators and rudder, steel tube structure, fabric covered. Fully retractable landing gear.
**Standard equipment.** Hamilton Standard controllable-pitch propeller, Goodrich tires, Bendix wheels and hydraulic brakes, Cleveland oleo shock absorber on one leg of landing gear, Reading battery, Pyle-National landing lights, Pyrene fire extinguisher, Plexiglas windshield and cabin enclosure, Eclipse starter, first aid equipment.
**Instruments.** Pioneer altimeter, air temperature gauge, clock, tachometer, airspeed and turn and bank indicators; Kollsman sensitive altimeter, manifold pressure gauge, engine gauge unit; Sperry directional gyro, gyro-horizon; Lewis thermocouple; fuel gauge; Weston ammeter; Daiber compass, Husun compass and Mark VIII compass; wheel position indicator.
*Other data in Dec., 1936,* AERO DIGEST.

## BELLANCA Bimotored Transport

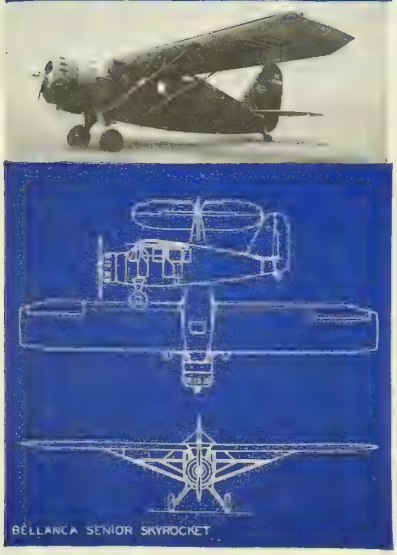
18-place **EXP.**



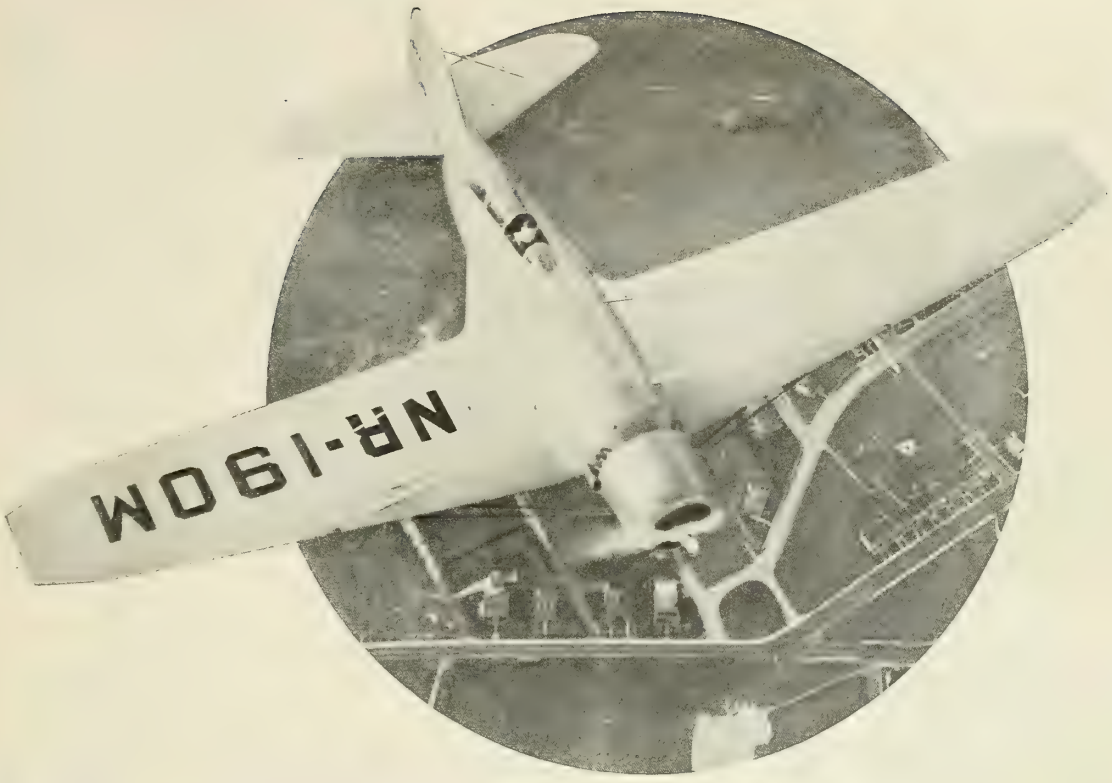

Landplane, amphibion, seaplane; data given in that order.
**Specifications.** Span 76′ (23.2 m.). Length 44′ (13.4 m.). Height 14′ (4.3 m.). Wing area 770 ft.² (71.5 m.²). Power loading 10 lbs./h.p. (4.5 kg./h.p.). Wing loading 18 lbs./ft.² (87.9 kg./m.²). Weight empty (lbs.) 8402; 10,700; 10,300: (kg.) 3811.1; 4853.5; 4672.1. Useful load (lbs.) 6020; 6120; 6210: (kg.) 2730.7; 2776; 2816.8. Payload (lbs.) 3700; 3890; 3890: (kg.) 1678.3; 1764.5; 1764.5. Gross weight (lbs.) 14,422; 16,910; 16,510: (kg.) 6541.8; 7670.4; 7488.9. Fuel 300 gals. (1135.6 lit.). Oil 24 gals. (90.8 lit.).
**Engine.** Wright Cyclone geared (two), 735 horsepower.
**Performance.** Maximum speed (m.p.h.) 195; 180; 180: (k.p.h.) 313.8; 389.7; 389.7. Cruising speed 170 m.p.h. (273.6 k.p.h.). Landing speed 58 m.p.h. (93.3 k.p.h.). Service ceiling (ft.) 27,000; 27,000; 22,000: (m.) 8229.6; 8229.6; 6705.6. Climb per min. (ft.) 1500; 1500; 1200: (m.) 457.2; 457.2; 365.8. Cruising range (mi.) 750; 750; 700: (km.) 1207.1; 1207.1; 1126.6.
**Construction.** Fuselage: chrome molybdenum steel tubing, welded; fabric covered. Wing: all-metal construction; fabric covered. Tail group: all metal; fabric covered twin fins and rudders, latter equipped with trim tabs. Wheels retract partially into wheel fairing on landplane; rudder-equipped floats for seaplane and amphibion; junction between floats and stub wing faired with aluminum alloy cuff.
**Standard equipment.** Hamilton Standard controllable pitch propellers, Goodyear tires, wheels and brakes, oleo shock absorbers, Exide battery, radio wiring, shielding and bonding, Wiley flares, landing lights, NACA cowls.
**Instruments.** Tachometer oil pressure, fuel gauges, altimeter, magnetic compass, airspeed indicator, rate of climb and bank and turn indicators, landing gear position indicator, Sperry gyro-horizon and directional gyro.
*Other data in Oct., 1934* AERO DIGEST.

## BELLANCA Senior Skyrocket

5 passengers—I pilot **ATC 565**




**Specifications.** Span 50′ 6″ (15.4 m.). Length 27′ 11″ (8.4 m.). Height 8′ 6″ (2.6 m.). Wing area 359 ft.² (33.6 m.²). Power loading 10.2 lbs./h.p. (4.6 kg./h.p.). Wing loading 15.5 lbs./ft.² (79.6 kg./m.²). Weight empty 3440 lbs. (1560 kg.). Useful load 2160 lbs. (980 kg.). Payload 976 lbs. (442.6 kg.). Gross weight 5600 lbs. (2540.2 kg.). Baggage 126 lbs. (51.2 kg.). Fuel 200 gals. (757 lit.). Oil 12.5 gals. (47.3 lit.).
**Engine.** P & W Wasp S3H1 rated 550 h.p. at 2200 r.p.m. at 5000 ft.
**Performance.** Maximum speed 190 m.p.h. (306 k.p.h.). Cruising speed 180 m.p.h. (290 k.p.h.). Landing speed with flaps 56 m.p.h. (90.2 k.p.h.); without flaps 64 m.p.h. (103 k.p.h.). Service ceiling 25,000 ft. (7725 m.). Climb per min. 1240 ft. (378.2 m.). Cruising range 600-1000 mi. (966-1611 km.).
**Construction.** Fuselage: chrome molybdenum welded steel tubing, spruce and plywood fairing; fabric covered. Wing: spars routed spruce; ribs plywood and spruce; all-metal trailing edge flaps, manually operated. Tail group: fin, rudder and elevators welded steel tubing; stabilizer routed spruce spars, spruce and plywood ribs; fabric covered. Also licensed as a seaplane on Edo floats. Fully swivelling tail wheel.
**Standard equipment.** General streamline 31″ tires, Goodrich 4 × 5 tail wheel tire, Hayes or Bendix wheels and brakes, Cleveland Pneumatic oleo shock absorbers, Exide battery, three navigation lights, Pyrene fire extinguisher, Johnson & Johnson first aid kit, Safe-T-Glass windshield and cabin glass, Dry Zero Blanket soundproof insulation, Eclipse direct electric starter, Hamilton Standard metal propeller, Eagle-Ottawa, Radel, Laidlaw or duPont materials of leather, fabric or Fabrikoid for the upholstery, as specified.
**Instruments.** Pioneer altimeter, clock tachometer, magnetic compass, airspeed, turn and bank, and rate of climb indicators; Mometer air temperature gauge; Kollsman engine gauge unit; Weston ammeter; flap position indicator, fuel gauge.




**★THE BELLANCA MODEL 28-70:**
WORLD'S FASTEST COMMERCIAL TYPE AIRPLANE. **Built under I.C.A.N. load factors to carry a Useful Load of 4276 Pounds at 272 m.p.h. on 700 h.p.**

**★BELLANCA MODEL 28-90:**
**The 1937 version of this craft with 900 h.p. Engine is now in production.**

*Bellanca also presents for 1937—*

**★BELLANCA SENIOR SKYROCKET:**
For business or sports use, 6-place, with 200 m.p.h. Top Speed. A.T.C. No. 565.

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As Freighter hauling ONE TON PAYLOAD on a single 420 h.p. Engine at 150 m.p.h. Cruising Speed. Also available in Ambulance and Photographic versions. A.T.C. No. 578.

**★BELLANCA AIR CRUISER:**
As Cargo carries TWO TON PAYLOAD on a geared "Cyclone" at better than 160 m.p.h. Cruising. Available also in 15-place Transport and 6-litter Ambulance versions. A.T.C. No. 563.

*Now being developed—*

**★BELLANCA MODEL 17-20:**
An ultra-modern 5-place single-engined cabin plane for the price range below $10,000. A full-cantilever low-wing monoplane with retracting landing gear and wing flaps, especially adapted for the needs of private and commercial use, with high-performance and low operating cost.

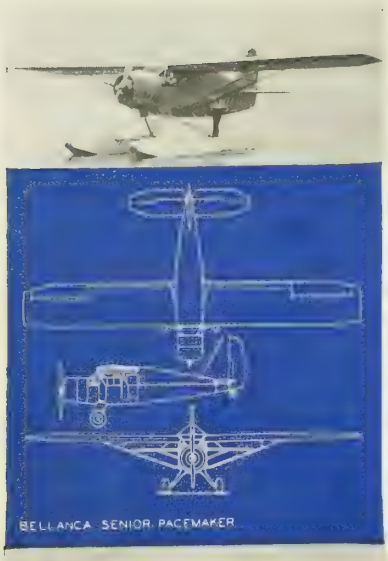
**★BELLANCA MULTI-MOTOR:**
Low-wing, full cantilever, 6-place cabin monoplane with retracting landing gear and wing flaps; offering high cruising speed with maximum safety features.

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**BELLANCA AIRCRAFT CORPORATION**

**New Castle, Delaware, U. S. A.** **Cables: "Bellanca—New Castle"**

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## BELLANCA Senior Pacemaker — 7 passengers—1 pilot — ATC 578

Models 31-42 and Freighter; data in that order; also 8 passengers and pilot.

**Specifications.** Span 50′ 6″ (15.4 m.). Length 27′ 11″ (8.4 m.). Height 8′ 6″ (2.6 m.). Wing area 359 ft.$^2$ (33.4 m.$^2$). Power loading 13.3 lbs./h.p. (5.9 kg./h.p.). Wing loading 15.5 lbs./ft.$^2$ (75.7 kg./m.$^2$). Weight empty 3250 lbs. (1474.2 kg.); 2950 lbs. (1338.1 kg.). Useful load 2350 lbs. (1066 kg.); 2650 lbs. (1202 kg.). Payload 998 lbs. (452.7 kg.). 2000 lbs. (907.2 kg.). Gross weight 5600 lbs. (2540.2 kg.). Baggage 148 lbs. (67.1 kg.). Fuel 200 gals. (757 lit.). Oil 12.5 gals. (47.3 lit.).

**Engine.** Wright Whirlwind R-975-E3 rated 420 h.p. at 2150 r.p.m.

**Performance.** Maximum speed 160 m.p.h. (257.5 k.p.h.). Cruising speed 145 m.p.h. (233 k.p.h.). Landing speed 64 m.p.h. (103 k.p.h.). Service ceiling 12,000 ft. (3657 m.). Climb per min. 700 ft. (213.3 m.). Cruising range 860-1100 mi. (1384-1770 km.).

**Construction.** Fuselage: chrome molybdenum welded steel tubing; spruce and plywood fairing members; fabric covered. Wings: spruce spars, routed; plywood and spruce ribs. Tail group: fin, rudder and elevators welded steel tubing; stabilizer routed spruce spars, spruce and plywood ribs; fabric covered. Fixed landing gear. Also licensed as seaplane on Edo model 6235 floats. Fully swivelling tail wheel.

**Standard equipment.** Hamilton Standard metal propeller, General Streamline tires, Goodrich tail wheel tire, Hayes or Bendix wheels and brakes, Cleveland Pneumatic oleo shock absorbers, Exide battery, navigation lights, bronze and ball bearing plane and engine control bearings, Pyrene fire extinguisher, Johnson & Johnson first aid kit, Safe-T-Glass wind-shield and cabin enclosure, Eclipse starter.

**Instruments.** Pioneer altimeter, turn and bank indicator, compass, tachometer, airspeed and rate of climb indicators, clock; Kollsman combination oil pressure, temperature and fuel gauge; Weston ammeter, manifold pressure gauge, thermocouple.




## BELLANCA Aircruiser Cargo — 2-15-place — ATC 563

Available as cargo plane, land transport, or seaplane.

**Specifications.** Span 65′ (19.8 m.). Length 42′ 9″ (13 m.). Height 11′ 9″ (3.5 m.). Wing area 664.2 ft.$^2$ (62 m.$^2$). Power loading 15.9 lbs./h.p. (7.1 kg./h.p.). Wing loading 17.2 lbs./ft.$^2$ (84 kg./m.$^2$). Weight empty 6115 lbs. (2773.8 kg.). Useful load 5285 lbs. (2397.3 kg.). Payload 4021 lbs. 1823.9 kg.). Gross weight 11,400 lbs. (5171 kg.). Fuel 300 gals. (1135.5 lit.). Oil 19 gals. (72 lit.).

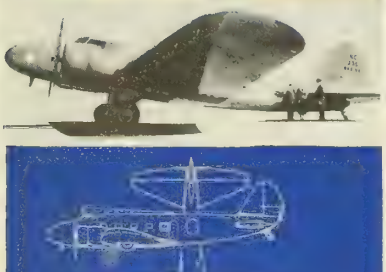
**Engine.** Wright Cyclone GR-1820G-3, 850 h.p. at 7500 ft. (2286 m.).

**Performance.** Maximum speed 178 m.p.h. (286.4 k.p.h.). Cruising speed 161 m.p.h. (259 k.p.h.) Landing speed 64 m.p.h. (103 k.p.h.) Service ceiling 22,000 ft. (6705 m.). Climb per min. 850 ft. (259 m.). Cruising range 610-1100 mi. (982-1770 km.).

**Construction.** Fuselage—welded chrome molybdenum steel tubing; fabric covered. Wing: spruce spars, stainless steel ribs; auxiliary wings of chrome molybdenum steel tubing, welded structure; fabric covered. Tail group: fin, rudder and elevators welded chrome molybdenum steel tubing; stabilizer of spruce spars, stainless steel ribs; fabric covered. Also licensed by the Dept. of Commerce as a seaplane on Edo model 12500 floats. Fully swivelling tail wheel.

**Standard equipment.** Goodyear 36 × 16 Airwheels, Goodyear 7 × 16 tail wheel tire, Goodyear wheels and brakes, Cleveland Pneumatic oleo shock absorbers, Exide storage battery, ball bearing and bronze bearings for plane and engine controls, three navigation lights, fixed landing lights in leading edge of wing, Pyrene fire extinguisher, Johnson & Johnson first aid kit. DuPont Fabrikoid upholstery. Safe-T-Glass windshield, duPont Pyralin cabin windows, lavatory equipment, Eclipse hand and electric starter, Hamilton Standard propeller.

**Instruments.** Pioneer altimeter, clock, tachometer, airspeed, turn and bank and rate of climb indicators; Kollsman engine gauge unit; Weston ammeter; manifold pressure, fuel and pressure gauges, thermocouple.




## BOEING 247-D — 10 passengers—2 pilots — ATC 558

**Specifications.** Span 74′ (22.57 m.). Length 51′ 7″ (15.72 m.). Height 12′ 1.75″ (3.7 m.). Wing area 836.13 sq. ft. (77.67 sq. m.). Empty weight 8940 lbs. (4058.76 kgs.). Useful load 4710 lbs. (2138.34 kgs.). Payload 2582 lbs. (1172.23 kgs.). Gross weight 13,650 lbs. (6197.10 kgs.). Power loading 12.4 lbs./h.p. (5.63 kgs./h.p.). Wing loading 16.3 lbs./sq. ft. (79. kgs./sq. m.). Baggage capacity 882 lbs. (400.18 kgs.). Fuel capacity 273 gals (72.22 lit.). Oil capacity 20 gals. (5.28 lit.).

**Engine.** P & W S1H1-G Wasp (two), 550 h.p. at 2200 r.p.m. at 8000 ft. (2438.4 m.).

**Performance.** Maximum speed 200 m.p.h. (322 k.p.h.). Cruising speed 189 m.p.h. (304 k.p.h.) at 2020 r.p.m. at 12,000 ft.; 180 m.p.h. (290 k.p.h.) at 2000 r.p.m. at 8,000 ft. Landing speed 62 m.p.h. (100 k.p.h.). Service ceiling 25,400 ft. (7750 m.). Rate of climb 1150 ft. 351 m.). per min. Cruising range 745 miles (1200 km.).

**Construction.** Fuselage: semi-monocoque; duralumin bulkheads, longerons, skin stiffeners and smooth skin covering. Wing: cantilever; spar trusses of square and rectangular aluminum alloy tubing, ribs and smooth metal skin. Tail group: cantilever; front and rear spars braced with ribs; fin and stabilizer, smooth skin covered; elevators and rudder, fabric covered.

**Standard equipment.** Goodrich tires, Warner wheels and brakes, Goodyear tail wheel tire, Fafnir bearings for engine and plane controls, Seapak insulation, Burgess soundproofing, Pyle-National navigation and landing lights, Kidde fire extinguisher, Pioneer flares, Pittsburgh windshield and cabin glass, Dayton lavatory, Eclipse starter, Hamilton Standard controllable-pitch propellers.

**Instruments.** Pioneer altimeter, thermocouple, tachometer, clock, compass, manifold, fuel and oil pressure gauges, oil and carburetor temperature gauges, fuel gauge, turn and bank, rate of climb, airspeed, wheel position indicators; Kollsman altimeter; Sperry gyropilot. Also instruments of Westinghouse, Elgin and MotoMeter manufacture.

# *Let's be sensible about* SAFETY

**There is no longer any necessity for the cabin plane owner to deny pilot or passengers the protection of aerial life-saving equipment. Manufacturing economies permit Switlik to offer these new chair chutes at low prices well within the easy reach of every cabin plane owner. Already the airplane builders listed on this page are prepared to install at their own plants Switlik chair chutes in new ships or in planes now flying.**

**Don't postpone for another day getting complete information about Switlik's contribution to flying safety.**

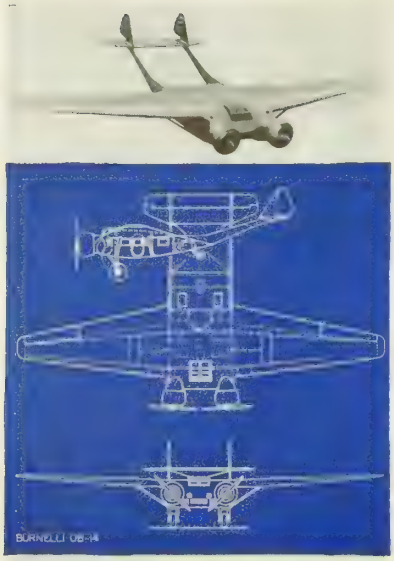
***The airplane builders listed below are equipped to install within their own plants, Switlik Chair Chutes in new ships and in planes now in operation.***

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REARWIN
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*6311 San Fernando Road, Glendale, California*






## BURNELLI UB-14

14 passengers—2 pilots

**EXP.**

**Specifications.** Span 71′ (21.6 m.). Length 44′ (13.4 m.). Height 10′ (3.1 m.). Wing area 686 ft.² (63.7 m.²). Power loading 9.65 lbs./h.p. (43.8 kg./h.p.). Wing loading 20.4 lbs./ft.² (99.6 kg./m.²). Empty weight 8000 lbs. (3628.8 kg.). Useful load 6000 lbs. (2721.6 kg.). Payload 3200 lbs. (1451.5 kg.). Gross weight 14,000 lbs. (6350.4 kg.). Fuel 300 gals. (1135.6 lit.). Oil 25 gals. (96.6 lit.).
**Engine.** P & W Hornet B (two) rated 750 h.p. at 2150 r.p.m.
**Performance.** Maximum speed 225 m.p.h. (362.1 k.p.h.). Cruising speed 200 m.p.h. (321.8 k.p.h.). Landing speed 63 m.p.h. (101.4 k.p.h.). Service ceiling 22,000 ft. (6705.6 m.). Climb per min. 1250 ft. (381 m.). Cruising range 600 mi. (965.6 m.).
**Construction.** Fuselage: all-metal dural box type; longitudinal bending taken by extruded aluminum alloy longerons and auxiliary stringers; longitudinal shear taken by 24ST aluminum alloy sheet of light gauges. Wing: NACA 2412 airfoil section, all-metal dural; aluminum alloy truss type ribs; 24ST skin; riveted construction; split-type all-metal hydraulically-operated flaps. Tail group: all-metal dural; truss and tension field dural covered. Semi-retractable landing gear, hydraulically operated; accessible for repair or adjustment in flight from the pilots' compartment. Retractable and swivelling tail wheel.
**Standard equipment.** Hamilton Standard controllable pitch propellers, Goodrich 12.5 × 14 tires, Autofan wheels and brakes, Cleveland Pneumatic oleo shock absorbers, Exide battery, SKF ball bearings for engine and plane controls, Pyle-National navigation lights, Pyrene fire extinguisher, Radel leather and fabric upholstery, American Window shatterproof windshield glass.
**Instruments.** Complete airline installation of Pioneer, Kollsman and Sperry products, including directional gyro, gyro-horizon, compass, sensitive altimeter, rate of climb and airspeed indicator, landing gear position indicator.
*Other data in Aug. 1935,* AERO DIGEST.

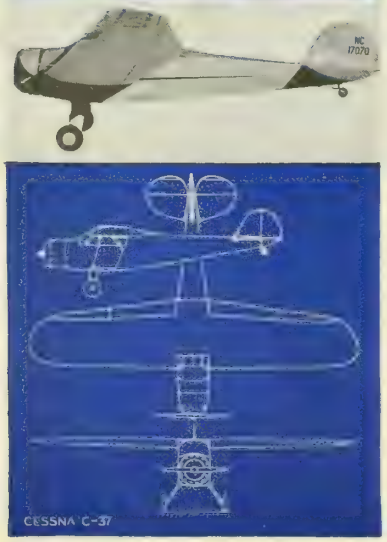



## CAMPBELL F

2-place

**EXP.**

**Specifications.** Span 36′ (11 m.). Length 19′ 4″ (2.8 m.). Height 6′ 6″ (1.9 m.). Wing area 145 ft.² (13.5 m.²) Power loading 17.75 lbs./h.p. (8.1 kg./h.p.). Wing loading 12.25 lbs./ft.² (59.8 kg./m.²). Weight empty 1240 lbs. (562.5 kg.). Useful load 535 lbs. (242.7 kgs.). Payload 205 lbs. (93 kgs.). Gross weight 1775 lbs. (805.1 kgs.). Baggage 35 lbs. (15.9 kgs.). Fuel 25 gals. 94.6 lit.). Oil 1.5 gals. (5.7 lit.).
**Engine.** Converted Ford V-8, 100 h.p. at 4000 r.p.m.
**Performance.** Maximum speed 112 m.p.h. (180.2 k.p.h.). Cruising speed 97 m.p.h. (156.1 k.p.h.). Landing speed with flaps 48 m.p.h. (77.2 k.p.h.); without flaps 55 m.p.h. (88.5 k.p.h.). Service ceiling 12,000 ft. (3657.6 m.). Climb per min. 350 ft. (106.7 m.). Cruising range 350 mi. (463.3 km.).
**Construction.** Fuselage: monocoque; side-by-side seating arrangement; throw-over controls; dual rudder pedals, adjustable and removable. Wing: flying wing type; full cantilever; single multicellular box spar, with system of stiffeners in skin where large part of normal flight loads are carried; light nose and tail section attached to spar; all-metal structure. Flaps on bottom surface of wing near trailing edge. Tail group: mounted on booms which are monocoque in design and detachable at trailing edge of wing; twin rudders. Engine mounted on four rubber engine supports directly on main spar of wing, pusher fashion. Weick type landing gear; two main wheels to rear of center of gravity; third wheel under nose of cabin and attached to rudder pedals for steering on ground.
**Standard equipment.** Fahlin propeller, Goodyear tires, wheels and hydraulic brakes, Bendix shock absorbers, Exide battery, ball-bearing engine and plane controls, navigation lights, Pyrene fire extinguisher, first aid equipment, Plastacele enclosure, Ford starter, Shakespeare throttle controls.
**Instruments.** Altimeter, air temperature gauge, airspeed indicator, compass, fuel pressure, oil pressure, oil temperature gauges, tachometer.




## CESSNA C-37

4-place

**ATC 622**

**Specifications.** Span 34′ 2″ (10.4 m.). Length 24′ 7″ (7.5 m.). Height 6′ 7″ (2 m.). Wing area 182 ft.² (16.9 m.²). Power loading 15.3 lbs./h.p. (6.9 kg./h.p.). Wing loading 12.3 lbs./ft.² (6.01 kg./m.²). Weight empty 1315 lbs. (596 kg.). Useful load 935 lbs. (425 kg.). Payload 558 lbs. (253 kg.). Gross weight 2250 lbs. (1020 kg.). Baggage 48 lbs. (21.8 kg.). Fuel 35 gals. (132.5 lit.). Oil 3.5 gals. (13.3 lit.).
**Engine.** Warner Super Scarab, 145 h.p. at 2050 r.p.m.
**Performance.** Maximum speed 162 m.p.h. (260.7 k.p.h.). Cruising speed 143 m.p.h. (230.1 k.p.h.). Landing speed with flaps 47 m.p.h. (75.6 k.p.h.); without flaps 54 m.p.h. (86.9 k.p.h.). Service ceiling 18,900 ft. (5760 m.). Climb per min. 1000 ft. (304.8 m.). Cruising range 525 mi. (845 km.).
**Construction.** Fuselage: chrome molybdenum steel tubing; wood fairing; fabric and aluminum alloy covered; fuselage, landing gear and tail wheel fork welded to form one unit with heat-treated members where necessary; double U-type hangers attach fuselage to rear wing spar; bushings through forward spar permit longerons to run continuous from fore to aft; one-piece stainless steel firewall. Wing: full cantilever, one-piece; tapered; continuous laminated spruce spars; plywood covered leading edge and tips. Flaps, trailing edge type, electrically operated by irreversible worm drive. Tail group: full cantilever; spruce fin and stabilizer; chrome molybdenum steel tubing rudder and elevators: trimming tabs on both elevators. Fixed landing gear.
**Standard equipment.** Fahlin wood propeller, Warner wheels and brakes, Cessna oil-draulic shock absorbers, Exide battery, Fafnir and Federal bearings for engine and plane controls, Grimes navigation lights, Shakespeare throttle controls, safety glass cabin enclosure, Eclipse starter, wind-driven generator, Pyrene fire extinguisher, NACA cowl.
**Instruments.** Kollsman altimeter, oil pressure and oil temperature gauges, tachometer, airspeed indicator, compass; fuel gauge.

# Surrealist Picture of Efficiency




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## CESSNA AIRCRAFT COMPANY

WICHITA, KANSAS, U. S. A.

EXPORT AGENT — AVIATION EQUIPMENT AND EXPORT, INC. 25 Beaver Street, New York City




## CRUSADER AG-7

7-place

**EXP.**

Models AG7-D, AG7-F and AG7-J; data given in that order.

**Specifications.** Span 48′ (14.6 m.). Length 29′ (8.8 m.). Height 9′ (2.7 m.). Wing area 350 ft.² (32.5 m.²). Power loading (lbs./h.p.) 10.93; 11.4; 13; (kg./h.p.) 4.9; 5.2; 5.9. Wing loading (lbs./ft.²) 20; 18.5: (kg./m.²) 97.6; 90.3. Empty weight 4700 lbs. (2126 kg.); 4100 lbs. (1860 kg.). Useful load 2300 lbs. (1040 kg.); 2400 lbs. (1088 kg.). Payload 1320 lbs. (600 kg.); 1420 lbs. (645 kg.). Gross weight 7000 lbs. (3170 kg.); 6500 lbs. (2950 kg.). Baggage 300 lbs. (136 kg.); 400 lbs. (181.5 kg.). Fuel (normal) 120 gals. (454.2 lit.); (maximum) 150 gals. (568 lit.). Oil 12 gals. (45.4 lit.).

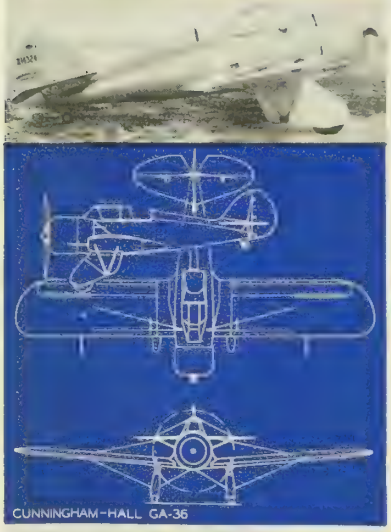
**Engines.** Wright Whirlwind R760E-2 (two), 320 h.p. at 2150 r.p.m.; Menasco C6S-4, 250 h.p. at 2350 r.p.m. at 5000 ft. (1524 m.); Jacobs L5, 285 h.p. at 2000 r.p.m.

**Performance.** Maximum speed 214 m.p.h. (342 k.p.h.); 210 m.p.h. (338 k.p.h.). Cruising speed 188 m.p.h. (300 k.p.h.) at 65% power; 190 m.p.h. (305.5 k.p.h.). Landing speed 65 m.p.h. (104 k.p.h.); 64 m.p.h. (103 k.p.h.). Service ceiling 23,000 ft. (7000 m.); 20,000 ft. (6100 m.). Climb per min. 1500 ft. (458 m.); 1000 ft. (304.8 m.). Cruising range 730 mi. (1170 km.); 720 mi. (1160 km.).

**Construction.** Fuselage: all-metal monocoque. Wing: full cantilever; center section all-metal 24S-T dural; outer panels wood box spars; plywood covered. Split type all-metal 24S-T dural flaps. Tail group: all-metal dural elevator and twin rudders fabric covered; supported at ends of two tapered elliptical dural tubes. Retractable landing gear.

**Standard equipment.** Hamilton Standard controllable pitch propellers, General tires, Autofan wheels and hydraulic brakes, Cleveland shock absorbers, Exide battery, Fafnir ball bearings for all controls, Grimes navigation and landing lights, Kidde and Pyrene extinguishers. Plexiglas windshield and cabin enclosure, Eclipse starter.

**Instruments.** Complete installation of flight and engine instruments.




## CUNNINGHAM-HALL GA-36

2-place

**EXP.**

**Specifications.** Span 30′ (9.2 m.). Length 20′ (6.1 m.). Height 6′5″ (1.9 m.). Wing area 131 ft.² (12.17 m.²). Power loading 14.5 lbs./h.p. (6.6 kg./h.p.). Wing loading 16.1 lbs./ft.² (78.5 kg./m.²). Weight empty 1490 lbs. (677 kg.). Useful load 610 lbs. (277 kg.). Payload 245 lbs. (111 kg.). Gross weight 2100 lbs. (953 kg.). Baggage 75 lbs. (34 kg.). Fuel 29 gals. (110 lit.). Oil 2.75 gals. (10.4 lit.).

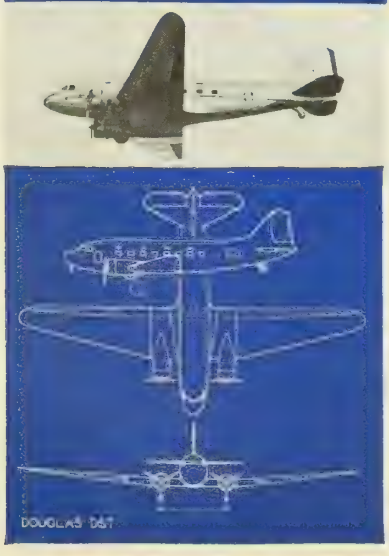
**Engine.** Warner Super Scarab, 145 h.p. at 2050 r.p.m.

**Performance.** Maximum speed 158 m.p.h. (254 k.p.h.). Cruising speed 140 m.p.h. (225 k.p.h.) at 136 m.p.h. (1900 r.p.m.). Landing speed with flaps 45 m.p.h. (72.4 k.p.h.); without flaps 63 m.p.h. (101.3 k.p.h.). Service ceiling 14,000 ft. (4270 m.). Climb per min. 850 ft. (259 m.). Cruising range 450 mi. (725 km.).

**Construction.** Fuselage: monocoque rear section with 17S-T sheet riveted to 17S-T formers; semi-monocoque forward section with 17S-T sheet riveted to chrome moly steel tube engine mount and transverse trusses for wing. Wing: bolted heat-treated chrome moly steel truss beams; riveted truss 17S-T tube ribs; 17S-T sheet and fabric covered. Full span flaps of 17S-T tube and channel members fabric covered. Tail group: chrome moly steel and 17S-T tube beams; 17S-T channel ribs; 17S-T sheet and fabric covered. Fixed landing gear.

**Standard equipment.** Hamilton Standard propeller, Goodrich tires and General tail wheel tire, Hayes wheels and brakes, Bendix shock absorbers, Norma-Hoffmann and Fafnir engine and plane control bearings, Pyle-National nagivation lights, Pyrene fire extinguisher, Eclipse starter, parking brake.

**Instruments.** Pioneer altimeter, tachometer, airspeed indicator and compass; Weston thermocouple; Taylor air temperature gauge and inclinometer; Kollsman unit-type fuel pressure oil pressure and oil temperature gauge; MotoMeter fuel gauge; Air Associates rate of climb indicator; flap position indicator; Elgin clock.




## DOUGLAS DC-3 and DST

14-21-place

**ATCs 607-618-619**

DST, sleep-plane version of DC-3 accommodates 14 berths. Both types available with either of the following engine installations: Wright Cyclone G-2, or G-102; or P & W SB-G Twin Wasp; data given in that order.

**Specifications.** Span 95′ (28.9 m.). Length 64′ 5.5″ (19.6 m.). Height 16′ 11.5″ (5.2 m.). Power loading (lbs./h.p.) 14.1; 13.33; 14.1: (kg./h.p.) 6.4; 6; 6.4. Wing loading 24.3 lbs./ft.² (118.6 kg./m.²). Weight empty (DST) 16,000 lbs. (7257.6 kg.); useful load 8000 lbs. (3628.4 kg.); payload 3500 lbs. (1587.6 kg.). Weight empty (DC-3 15,300 lbs. (6940 kg.); useful load 8700 lbs. (3946.4 kg.); payload 4200 lbs. (1905.1 kg.). Gross weight 24,000 lbs. (10,886.4 kg.).

**Engines.** (two) G-2 Wright Cyclone, 850 h.p. at 2100 r.p.m.; G-102 Wright Cyclone 900 h.p. at 2200 r.p.m.; P & W SB-G Twin Wasp, 850 h.p. at 2450 r.p.m.

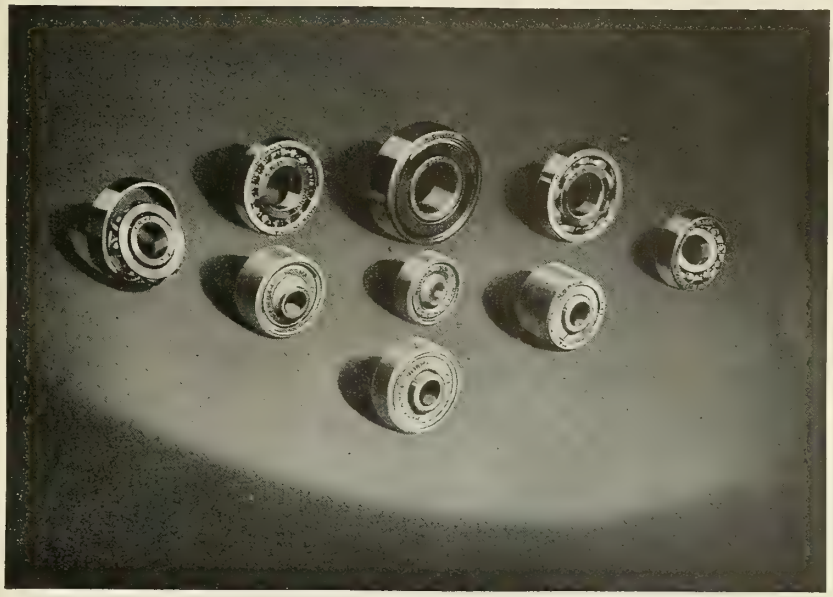
**Performance.** Maximum speed (m.p.h.) 212 at 6800 ft.; 216 at 7000 ft.; 209 at 8000 ft.; (k.p.h.) 341.2 at 2072.6 m.; 347.6 at 2134 m.; 336.4 at 2438 m. Cruising speed (m.p.h.) 188 at 1200 ft.; 188 at 1000 ft.; 192 at 1000 ft.; (k.p.h.) 302.6 at 365.8 m.; 302.6 at 304.8 m.; 309 at 304.8 m. Landing speed 64 m.p.h. (103 k.p.h.). Service ceiling (ft.) 20,800; 21,800; 21,500: (m.) 6339.6; 6644.3; 6552.9. Cruising range (mi.) 1650; 1545; 1685: (km.) 2655.5 2486.5; 2711.8

**Construction.** Fuselage: semi-monocoque; aluminum alloy frames and longitudinals; Alclad covered. Wing: full cantilever; multicelluar construction, stressed skin; tapering from NACA 2206 at tip to NACA 2215 at root; aluminum alloy spars and ribs; Trailing edge split type flaps. Tail group: multi-cellular structure, aluminum alloy frame. Retractable landing gear.

**Standard equipment.** Hamilton Standard controllable pitch propellers, Bendix wheels, brakes and shock absorbers, landing and navigation lights, fire extinguisher system for engines, Sperry gyro-pilot, Eclipse starters.

**Instruments.** Complete airline installation of flight and engine instruments.

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## DOUGLAS Flying Boat DF

32-place

**ATC**

*ATC pending.

**Specifications.** Passenger compartment convertible into 16-berth sleeper. Span 95′ (28.9 m.). Length 69′ 10.5″ (21.3 m.). Height 24′ 6.25″ (7.5 m.). Wing area 1295 ft.² (120.3 m.²). Power loading 16.7 lbs./h.p. (7.6 kg./h.p.). Wing loading 22 lbs./ft.² (107.4 kg./m.²). Weight empty 17,315 lbs. (7854.1 kg.). Useful load 11,185 lbs. (5073.5 kg.). Payload 6755 lbs. (3064.1 kg.) inc. fuel for 1000-mi. (1609.4 km.) range and full load of passengers and baggage. Gross weight 28,500 lbs. (12,927.6 kg.). Fuel 1620 gals. (6132.3 lit.). Oil 100 gals. (378.5 lit.).

**Engines.** Wright Cyclone SGR1820-G2, (two) rated 850 h.p. at 2100 r.p.m.

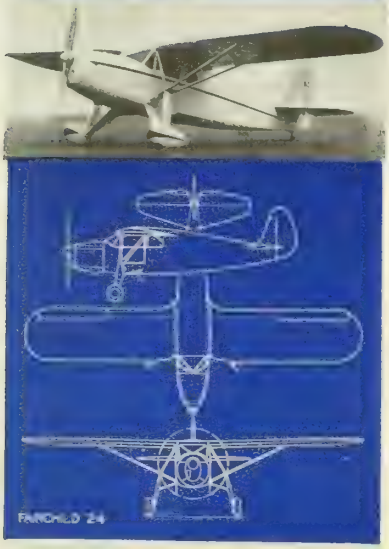
**Performance.** Maximum speed 178 m.p.h. (286.5 k.p.h.) at 6800 ft. (2072.6 m.). Cruising speed 160 m.p.h. (257.5 k.p.h.) at 9000 ft. (2743.2 m.). Landing speed with flaps 65 m.p.h. (104.6 k.p.h.). Service ceiling 13,900 ft. (4236.7 m.). Climb per min. 800 ft. (243.8 m.). Cruising range 2750 mi. (4425.8 km.).

**Construction.** Hull: semi-monocoque, smooth sheet metal covering; two-step type; divided into compartments formed by transverse bulkheads. Wing: full cantilever; beam section spars; built-up framework ribs; metal and fabric covered; NACA 2211.5 and 2218 airfoil sections; flat-span center section and two outer panels; corrugated metal covering extends from leading edge to about 66% of chord. Flaps hydraulically operated. Tail group: full cantilever; all-metal, except movable surfaces which are fabric covered; trim tabs on elevator and rudder. One-step auxiliary floats connected with wing by single flat box-type strut; hydraulically retractable.

**Standard equipment.** Hamilton Standard constant speed propellers, Eclipse starter, Dietz landing lights, Grimes navigation lights, Western Electric radio, NACA cowlings, de-icers on wing, empennage and propellers, radio shielding, Lear direction finder.

**Instruments.** Complete installation of flight and engine instruments, including Cambridge aero mixture indicator, Sperry gyropilot.

*Other data in Nov. 1936* AERO DIGEST.



## FAIRCHILD 24

3-place

**ATC 600-610**

Models C-8-G and C-8-H; data given in that order.

**Specifications.** Span 36′4″ (11.1 m.). Length 23′9″ (7.2 m.); 24′10″ (7.6 m.). Height 8′ (2.4 m.). Wing area 173.2 ft.² (16.1 m.²). Power loading 16 lbs./h.p. (7.2 kg./h.p.). Wing loading 13.9 lbs./ft.² (67.7 kg./m.²). Weight empty 1491 lbs. (676.3 kg.); 1569 lbs. (711.7 kg.). Useful load 909 lbs. (412.3 kg.); 831 lbs. (376.9 kg.). Payload 440 lbs. (199.6 kg.) 390 lbs. (176.9 kg.). Gross weight 2400 lbs. (1088.6 kg.). Baggage 100 lbs. (45.4 kg.); 50 lbs. (22.7 kg.). Fuel 40 gals. (151.4 lit.). Oil 3 gals. (11.4 lit.).

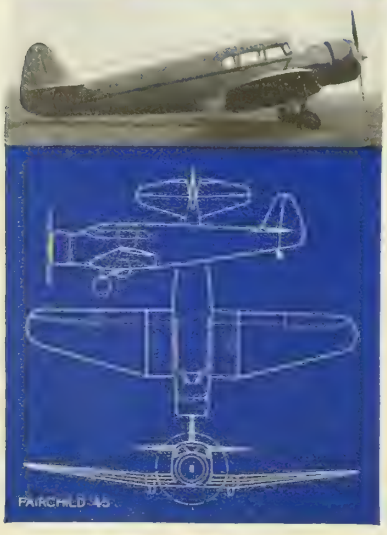
**Engine.** Warner Super Scarab, 145 h.p. at 2050 r.p.m.; Ranger 6-390-D-3, 150 h.p. at 2350 r.p.m.

**Performance.** Maximum speed 117.5 m.p.h. (189.1 k.p.h.); 124 m.p.h. (199.6 k.p.h.). Cruising speed 113.5 m.p.h (182.7 k.p.h.) at 112 h.p. (1900 r.p.m.); 115 m.p.h. (185.1 k.p.h.) at 112 h.p. (2100 r.p.m.). Landing speed with flaps 44.3 m.p.h. (71.3 k.p.h.). Service ceiling 14,750 ft. (4495.8 m.); 14,100 ft. (4297.7 m.). Climb per min. 715 ft. (217.9 m.); 650 ft. (198.1 m.). Cruising range 450 mi. (724.2 km.); 500 mi. (804.7 km.).

**Construction.** Fuselage: welded steel tubing; square section longeron; fabric covered. Wing: N-22 section; spruce spars; truss spruce ribs; metal compression members; fabric covered. Dural flaps; wood ribs; manually operated. Tail group: stabilizer and fin, wood and plywood; elevators and rudder, welded steel tube fabric covered. Fixed landing gear.

**Standard equipment.** Hartzell propeller, Goodrich tires and Goodyear tail wheel tire, Warner wheels and brakes, oil-spring shock absorbers, Reading battery, Grimes navigation lights, Pyrene fire extinguisher, Seapak insulation, Eclipse starter, Lunkenheimer primer, Harrison oil cooler, Electric Specialties generator.

**Instruments.** Aeromarine altimeter, oil pressure, oil temperature gauges, tachometer, airspeed indicator; Kollsman compass; Fairchild flap position indicator.



## FAIRCHILD 45

5-place

**ATC 603**

**Specifications.** Span 39′6″ (12 m.). Length 30′3.37″ (9.3 m.). Height 8′ (2.4 m.). Wing area 248 ft.² (23 m.²). Power loading 12.5 lbs./h.p. (5.7 kg./h.p.). Wing loading 16.1 lbs./ft.² (78.1 kg./m.²). Weight empty 2512 lbs. (1139.4 kg.). Useful load 1488 lbs. (675 kg.). Payload 733 lbs. (332.5 kg.). Gross weight 4000 lbs. (1814.4 kg.). Baggage 53 lbs. (24 kg.). Fuel 90 gals. (340.7 lit.). Oil 7.5 gals. (28.4 lit.).

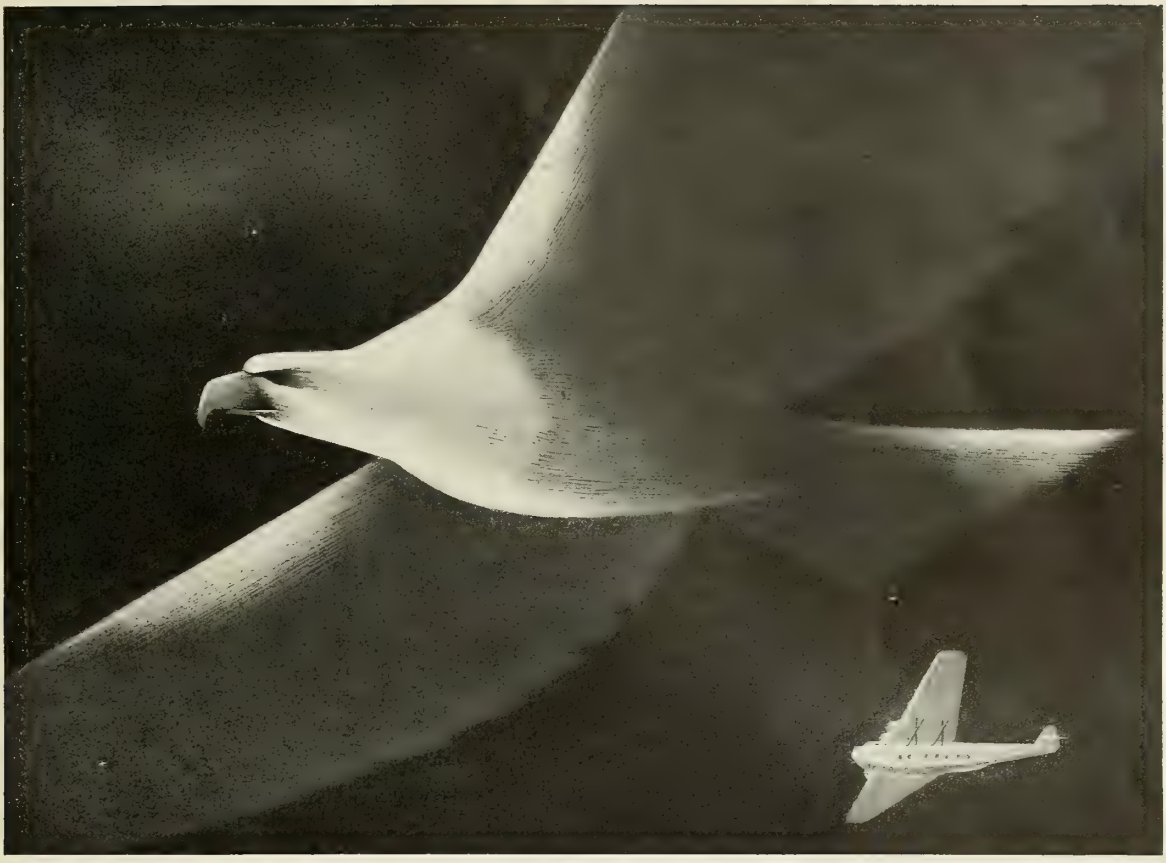
**Engine.** Wright Whirlwind R-760E-2, 320 h.p. at 2200 r.p.m.

**Performance.** Maximum speed 170 m.p.h. (273.6 k.p.h.). Cruising speed 165 m.p.h. (265.6 k.p.h.) at 225 h.p. (1950 r.p.m.) at 5000 ft. (1524 m.). Landing speed with flaps 62 m.p.h. (83.7 k.p.h.); without flaps 57 m.p.h. (91.7 k.p.h.) Service ceiling 20,000 ft. (6096 m.). Climb per min. 1100 ft. (335.3 m.). Cruising range 840 mi. (1351.9 km.).

**Construction.** Fuselage: steel trussed; fabric and aluminum covered. Wing: spars, spruce on outer panels, aluminum alloy on center panel; ribs, aluminum alloy and spruce. Aluminum alloy flaps manually operated. Tail group: aluminum alloy, fabric covered; elevators and rudder aerodynamically balanced. Fully retractable landing gear, electrically operated. Swivelling tail wheel.

**Standard equipment.** Hamilton Standard controllable pitch propeller, Goodrich tires and Goodyear Streamlined tail wheel tire, Hayes wheels and hydraulic brakes, oil-spring shock absorbers, Exide battery, SKF and Norma-Hoffmann and Fafnir ball bearings for controls, Grimes navigation and landing lights, Pyrene fire extinguisher, Bauer & Black first aid equipment, Laidlaw upholstery, Pittsburgh safety glass, Seapack insulation, Eclipse starter, Shakespeare throttle controls.

**Instruments.** Kollsman altimeter, clock, manifold pressure, fuel pressure, oil pressure and oil temperature gauges, tachometer, airspeed and rate of climb indicators, compass; Weston thermocouple; ammeter; Pioneer turn and bank indicator; AC fuel gauge; Fairchild wheel and flap position indicators.



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## FAIRCHILD Amphibion — 8 passengers—2 pilots — ATC 587



Models A-942-A and A-942-B; data given in that order. ATC on model A only.

**Specifications.** Span 56′ (17.1 m.). Length 46′ 8.37″ (14.2 m.). Height 16′ 3″ (5 m.); 17′ 2″ (5.2 m.). Wing area 483 ft.² (44.9 m.²). Power loading 12.92 lbs./h.p. (5.9 kg./h.p.). Wing loading 20.02 lbs./ft.² (97.8 kg./m.²). Weight empty 6500 lbs. (2948.4 kg.). Useful load 3200 lbs. (1451.5 kg.). Payload 1800 lbs. (816.5 kg.). Gross weight 9700 lbs. (4400 kg.). Baggage 480 lbs. (217.7 kg.). Fuel 180 gals. (681.4 lit.). Oil 25 gals. (94.6 lit.).

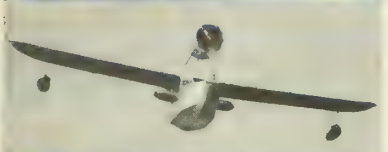
**Engine.** P & W Hornet S2E-G rated 750 h.p. at 2250 r.p.m. at 2500 ft.; Wright Cyclone SGR1820F-52 rated 750 h.p. at 2100 r.p.m. at 5600 ft.

**Performance.** Maximum speed 173 m.p.h. (278.4 k.p.h.). Cruising speed 151 m.p.h. (243 k.p.h.) at 66% power at 8000 ft. (2438.4 m.). Landing speed with flaps 61 m.p.h. (98.2 k.p.h.). Service ceiling 18,000 ft. (5486.4 m.). Climb per min. 950 ft. (289.6 m.). Cruising range 660 mi. (1062.2 km.).

**Construction.** Amphibion. Hull: aluminum alloy sheet, riveted. Wing: spars aluminum alloy riveted tension field girder; ribs aluminum alloy riveted truss. Progressive split type manually or electrically operated flaps. Tail group: fin, stabilizer, rudder and elevators, metal, fabric covered.

**Standard equipment.** Goodyear tires, wheels and hydraulic brakes, Cleveland Pneumatic shock absorbers, Exide battery, Grimes navigation lights, Pyle-National landing lights, Kidde fire extinguisher, Wiley flares, first aid kit, Pittsburgh DuPlate windshield and cabin enclosure, Seapak insulation, Eclipse starter and generator, Hamilton Standard controllable pitch propeller.

**Instruments.** Kollsman altimeter; Pioneer air temperature, manifold pressure, fuel, fuel and oil pressure and oil temperature gauges, clock, tachometer, airspeed, turn and bank, and rate of climb indicators, compass, wheel and flap position indicators; Sperry directional gyro, gyro-horizon; Weston thermocouple, ammeter.



## FLEETWINGS Sea Bird — 4-place — *ATC




*ATC pending.

**Specifications.** Span 40′ 6″ (12.36 m.). Length 31′ 5.5″ (9.62 m.). Height 12′ 6″ (3.82 m.). Wing area 235 ft.² (21.8 m.²). Power loading 12.1 lbs./h.p. (5.5 kg./h.p.). Wing loading 14.6 lbs./ft.² (71.3 kgs./m.²) Weight empty 2320 lbs. (1052.3 kg.). Useful load 1130 lbs. (512.6 kg.). Payload 610 lbs. (276.7 kg.). Gross weight 3450 lbs. (1564.9 kg.). Baggage 100 lbs. (45 kg.). Fuel 52 gals. (196.8 lit.). Oil 5 gals. (18.9 lit.).

**Engine.** Jacobs L-5, 285 h.p. at 2000 r.p.m.

**Performance.** Maximum speed 150 m.p.h. (241 k.p.h.). Cruising speed 133 m.p.h. (214 k.p.h.). Landing speed with flaps 50 m.p.h. (80.5 k.p.h.). Service ceiling 15,000 ft. (4572 m.). Climb per min. 900 ft. (274 m.). Cruising range 400 mi. (644 km.).

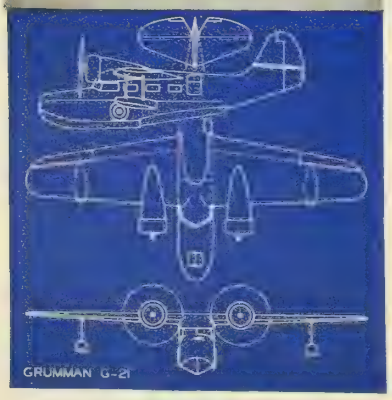
**Construction.** Amphibion. Hull: all-metal, stainless steel, shotwelded; monocoque type; stresses carried by built-up steel tubes; light former rings tied together fore and aft with light stringers to which skin is shotwelded; throwover wheel control. Wing: all-metal, stainless steel; fabric covered; two spar type with intermediate ribs and built-up drag struts and double diagonal tie rod bracing; box type spars with webs and caps corrugated longitudinally and provided with internal stiffeners. All-metal hydraulically operated flaps. Tail group: all-metal, fabric covered; corrugated metal trim tabs on elevators and rudder. Retractable landing gear.

**Standard equipment.** Curtiss propeller, General streamline tires, Goodrich tail wheel tire, Bendix Pneudraulic shock absorbers, Exide battery, Grimes navigation and landing lights, Pyrene fire extinguisher, International flares, Plexiglas windshield and cabin enclosure, Sperry soundproofing, Seapak insulation, Eclipse starter, bonding and shielding.

**Instruments.** Eclipse flowmeter; Kollsman altimeter, engine gauge unit, and compass; Pioneer tachometer, airspeed, turn and bank, and rate of climb indicators; General Electric volt-ammeter, carburetor temperature gauge; Waltham clock; Air Associates manifold pressure gauge.



## GRUMMAN G-21 — 6-8-place — *ATC




*ATC pending.

**Specifications.** Span 49′ (14.9 m.). Length 38′ 3″ (11.6 m.). Height 12′ 2″ (3.7 m.). Wing area including ailerons 375 ft.² (34.8 m.²). Power loading 9.37 lbs./h.p. (4.2 k./h.p.). Wing loading 20 lbs./ft.² (97.6 k./m.²). Weight empty 5082 lbs. (2305.2 kgs.). Useful load 2418 lbs. (1096.8 kgs.). Payload 1120 lbs. (508 kgs.). Gross weight 7500 lbs. (3402 kgs.). Baggage allowance 100 lbs. (45.4 kgs.). Fuel 200 gal. (757.1 lit.). Oil 14 gal. (53 lit.).

**Engines.** Pratt & Whitney Wasp Junior R-985 (two), rated 400 h.p. at 2200 r.p.m. and 300 h.p. (cruising) at 2200 r.p.m. at 9600 ft. (2926.1 m.).

**Performance.** (Estimated) maximum speed 180 miles per hour (289.7 k.p.h.). Cruising speed 170 m.p.h. (273.6 k.p.h.). Cruising range 830 miles (1335.8 km.).

**Construction.** Amphibion. Hull: all-metal, 24S-T, riveted; corrosion proofed; large door on left side of hull aft of trailing edge of wing; hatch in bow with companionway leading to cockpit; dual wheel controls. Wing: all-metal, 24S-T; cantilever; single box spar type; ailerons statically and dynamically balanced; wing tip floats. All-metal 24S-T flaps, vacuum operated. Tail group: all-metal,, 24S-T; fin and stabilizer, metal covered; elevators and rudder fabric covered; rudder and elevators balanced.

**Standard equipment.** Hamilton Standard propellers, Goodrich tires, Bendix wheels, brakes and shock absorbers, Fafnir and Norma-Hoffmann bearings for engine and plane controls, navigation and landing lights, Kidde engine fire extinguisher system, Pyrene hand type fire extinguisher, non-shatterable windshield and cabin glass, Federal Laboratories Coffman cartridge-type starter, heating and ventilation systems.

**Instruments.** Altimeter, manifold pressure gauge, clock, fuel gauge, fuel pressure, oil pressure and oil temperature gauges, tachometers, ammeter, airspeed, turn and bank and rate of climb indicators, compass, carburetor temperature gauge.

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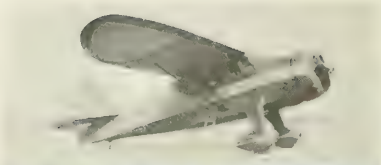
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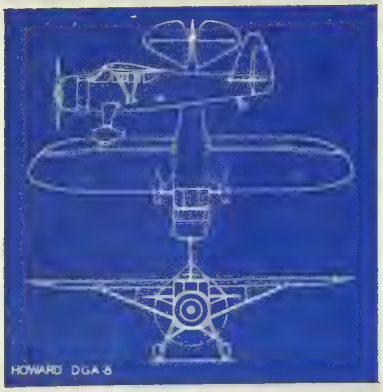
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## HOWARD DGA-8

4-place

**ATC 612**

**Specifications.** Span 38′ (11.6 m.). Length 25′ 8″ (7.8 m.). Height 9′ 5″ (2.9 m.). Wing area 185.5 ft.² (17.2 m.²). Power loading 11.87 lbs./h.p. (5.6 kg./h.p.). Wing loading 20.48 lbs./ft.² (100 kg./m.²). Empty weight 2300 lbs. (1043.3 kg.). Useful load 1500 lbs. (680.4 kg.). Payload 737 lbs. (334.3 kg.). Gross weight 3800 lbs. (1723.7 kg.). Baggage 120 lbs. (54.4 kg.). Fuel 90 gals. (340.7 lit.). Oil 7 gals. (26.5 lit.).

**Engine.** Wright Whirlwind R760E-2, 320 h.p. at 2200 r.p.m.

**Performance.** Maximum speed 187 m.p.h. (300.9 k.p.h.). Cruising speed 187 m.p.h. (300.9 k.p.h.) at 7500 ft. (2286 m.) at 2150 r.p.m. (246 h.p.). Landing speed with flaps 46 m.p.h. (74 k.p.h.); without flaps 51 m.p.h. (82 k.p.h.). Service ceiling 20,000 ft. (6096 m.). Climb per min. 1800 ft. (548.6 m.). Cruising range 860 mi. (1384.1 km.).

**Construction.** Fuselage: welded chrome molybdenum steel tubing; dural and fabric covered. Wing: solid spruce spars, built up ribs; plywood and fabric covered. Aerodynamically-balanced manually operated flaps; plywood and fabric covered. Tail group: welded steel tube and channel sections. Fixed landing gear. Swivelling tail wheel.

**Standard equipment.** Hamilton Standard controllable pitch propeller, Goodyear tires, wheels and hydraulic brakes, Howard oleo and spring shock absorbers, Exide battery, Norma-Hoffmann control bearings, Grimes navigation and retracting landing lights, Pyrene fire extinguisher, International flares, Eagle Ottawa upholstery, Eclipse starter and generator, Romec fuel and wobble pumps, Cuno oil filter, Seapak insulation.

**Instruments.** Kollsman sensitive altimeter; Taylor air temperature gauge and cabin thermometer; Weston thermocouple; Pioneer fuel pressure, oil pressure and oil temperature gauges, turn and bank indicator; Air Associates manifold pressure gauge, tachometer, airspeed and rate of climb indicators, carburetor temperature gauge Diaber compass; AC fuel gauge, ammeter, oil level gauge, stabilizer; Arens controls.






## JONES S-125

2-place

***ATC**

*ATC pending.

**Specifications.** Span 31′ (9.4 m.). Length 24′ 2″ (7.4 m.). Height 7′ 3″ (2.2 m.). Wing area 140.5 ft.² (13.05 m.²). Power loading 16 lbs./h.p. (7.3 kg./h.p.). Wing loading 14.23 lbs./ft.² (69.5 kg./m.²). Weight empty 1125 lbs. (510.3 kg.). Useful load 875 lbs. (396.9 kg.). Payload 386 lbs. (175.1 kg.). Gross weight 2000 lbs. (907.2 kg.). Baggage 196 lbs. (88.9 kg.). Fuel 46 gals. (174 lit.). Oil 3 gals. (11.4 lit.).

**Engine.** Menasco C-4, 125 h.p. at 2175 r.p.m.; also available with Menasco C-4S, 150 h.p. at 2260 r.p.m.

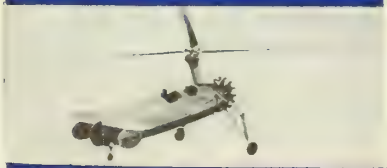
**Performance.** Maximum speed 151 m.p.h. (243 k.p.h.). Cruising speed 136 m.p.h. (219 k.p.h.). Landing speed 46 m.p.h. (74 k.p.h.). Service ceiling 14,100 ft. (4298 m.). Climb per min. 1020 ft. (430 m.). Cruising range 730 mi. (1175 m.).

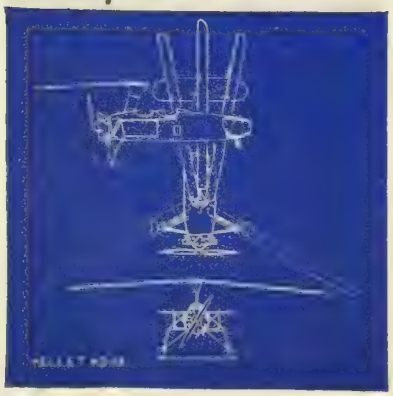
**Construction.** Fuselage: steel tubular frame; removable metal fairing from firewall to trailing edge of wing, fabric covering aft of this point; tandem seating with dual controls; telescoping three-sectioned reinforced canopy top. Wing: cantilever two box spar, plywood and fabric covering; modified Frieze-type ailerons. Tail group: fin and stabilizer full cantilever two box spar type with wood spars and plywood ribs, plywood and fabric covering; elevators and rudder dural frame, fabric-covered; trim tab on one elevator. Cantilever landing gear with faired individual legs; gear consists of a fork fixed to a shock strut braced and guided by a tripod fixed to the front spar and a tubular truss between the spars. Fully swivelling tail wheel.

**Standard equipment.** Sensenich wood propeller, mechanical brakes, parking brakes, wobble pump, oildraulic shock absorbers, Norma-Hoffmann and Fafnir engine and plane control bearings; fire extinguisher, first aid equipment, radio shielding and bonding.

**Instruments.** Altimeter, visual fuel gauge, airspeed indicator, compass, tachometer, fuel pressure, oil pressure and oil temperature gauges.

*Other data in Dec., 1936,* Aero Digest.





## KELLETT KD-1A

2-place

**EXP.**

**Specifications.** Rotor diameter 40′ (12.2 m.). Length 25′10.5″ (7.9 m.). Height 10′2.5″ (3.1 m.). Power loading 9.8 lbs./h.p. (4.5 kg./h.p.). Weight empty 1538 lbs. (697 kg.). Useful load 662 lbs. (300 kg.). Payload 210 lbs. (95.4 kg.). Gross weight 2200 lbs. (1000 kg.). Baggage 40 lbs. (18.4 kg.). Fuel 42 gals. (159 lit.). Oil 4 gals. (15.1 lit.).

**Engine.** Jacobs L—4MA, 225 h.p. at 2000 r.p.m.

**Performance.** Guaranteed maximum speed 120 m.p.h. (193 k.p.h.). Minimum speed, level flight at sea level 25 m.p.h. (40 k.p.h.) Landing speed nil. Service ceiling 13,000 ft. (3960 m.). Climb per min. 1000 ft. (304.5 m.). Cruising range 297 mi. (477 km.).

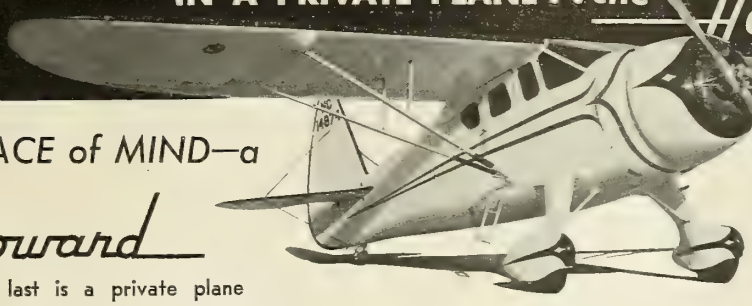
**Construction.** Wingless autogiro. Fuselage: steel tubing throughout with fittings of alloy steel; fabric covered; tandem seating. Rotor system: three blades with alloy steel tube spars, inner ends of spars contain hydraulic dampers for controlling blade position about vertical hinge pins; hub machined from alloy steel; strut of chrome molybdenum steel tubing; rotor blades are of folding type and are attached to the hub which rotates on a short spindle so mounted that it can be tilted by movement of the control stick. Tail group: steel tubing; fabric covered; vertical surfaces give directional stability; small rudder; no elevators. Fixed landing gear. Steerable tail wheel.

**Standard equipment.** 7 × 5 wheels with brakes, 10.5″ streamline tail wheel, pneumatic shock absorbers, ball and needle bearings for engine and flight controls, electric engine starter, hand fire extinguisher, one-piece metal propeller, first aid kit, adjustable pilot's seat, generator and battery, navigation lights, indirectly lighted instrument panels.

**Instruments.** (rear cockpit) altimeter, compass, engine gauge unit (fuel and oil pressure and oil temperature gauges), airspeed indicator, engine tachometer, rotor tachometer, volt-ammeter, turn and bank indicator, clock, fuel sight gauges: (front cockpit) altimeter, airspeed indicator, engine tachometer, rotor tachometer.

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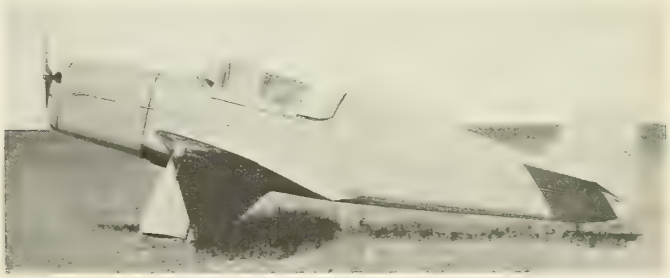
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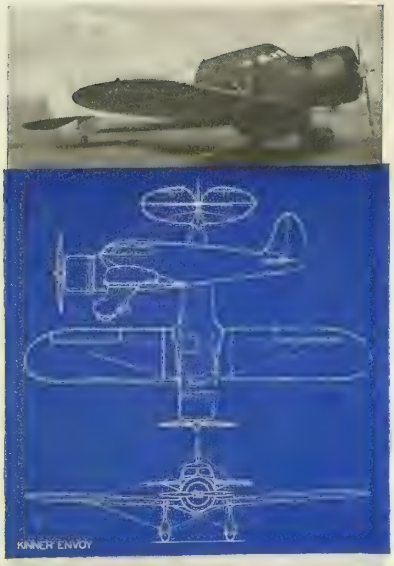
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## KINNER Envoy

4-place

**ATC 532**

**Specifications.** Span 39′ 8″ (11.9 m.). Length 28′ 7.5 (8.5 m.). Height 8′ 6″ (2.4 m.) Wing area 229 ft.² (21.4 m.²). Power loading 11.62 lbs./h.p. (5.3 kg./h.p.). Wing loading 18.77 lbs./ft.² (91.7 kg./m.²). Weight empty 2850 lbs. (1295 kg.). Useful load 1450 lbs. (656 kg.). Payload 608 lbs. (276 kg.). Gross weight 4300 lbs. (1951 kg.). Baggage 98 lbs. (44.5 kg.). Fuel 102 gals. (385 lit.). Oil 8 gals. (31 lit.).

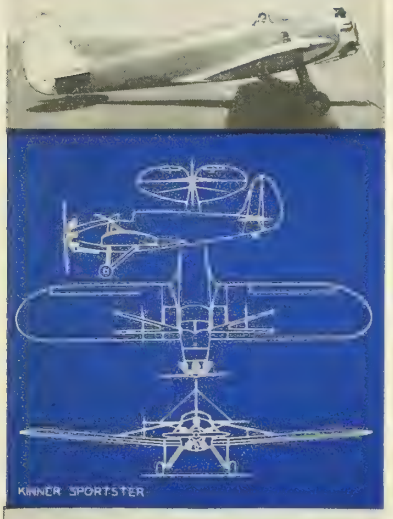
**Engine.** Kinner SC-7, 370 h.p. at 1900 r.p.m. at 5000 ft. (1524 m.).

**Performance.** Maximum speed 185 m.p.h. (297 k.p.h.) at 5000 ft. (1524 m.); 170 m.p.h. (274 k.p.h.) at sea level. Cruising speed 169 m.p.h. (272 k.p.h.) at 5000 ft. (1524 m.); 155 m.p.h. (250 k.p.h.) at sea level. Landing speed with flaps 55 m.p.h. (88.5 k.p.h.); without flaps 60 m.p.h. (96.7 k.p.h.). Service ceiling 18,000 ft. (5500 m.). Climb per min. 1200 ft. (365 m.). Cruising range 700 mi. (1030 km.).

**Construction.** Fuselage: welded chrome molybdenum steel tubing; metal and fabric covered. Wing: spruce spars and ribs; double drag truss; fabric covered; wire braced; Clark Y airfoil section. Flaps split trailing edge type, partial span, electrically operated. Tail group: welded chrome molybdenum steel tubing; fabric covered; tabs on elevators.

**Standard equipment.** Hamilton Standard adjustable pitch propeller, Eclipse starter, General Streamline tires, Autofan wheels, parking and taxiing brakes, oil and spring shock absorbers, Exide battery, Grimes navigation lights, friction quadrant type throttle controls, ball bearing engine and plane controls, Pyrene fire extinguisher, non-shatterable windshield and cabin glass, complete soundproofing, NACA cowl, Lord rubber engine mount, indirectly lighted instrument panel mounted in rubber, radio receiver, streamlined wheel pants, shielding and bonding.

**Instruments.** Kollsman altimeter, airspeed and rate of climb indicators, compass; Pioneer turn and bank indicator, oil temperature, oil pressure, fuel pressure gauges, tachometer; Weston ammeter; fuel guage.




## KINNER Sportster

2-place

**ATCs 516-490**

Models B and K; data given in that order.

**Specifications.** Span 39′ (11.9 m.). Length 24′ 2″ (7.5 m.). Height 7′ (2.1 m.). Wing area 227 ft.² (21.1 m.²). Power loading 15 lbs./h.p. (6.8 kg./h.p.); 18.75 lbs./h.p. (8.5 kg./h.p.). Wing loading 8.25 lbs./ft.² (40.3 kg./m.²). Weight empty 1272 lbs. (577 kg.); 1257 lbs. (570.2 kg.). Useful load 603 lbs. (273.5 kg.); 618 lbs. (280.3 kg.). Payload 206 lbs. (93.4 kg.); 221 lbs. (100.2 kg.). Gross weight 1875 lbs. (850.5 kg.). Baggage 35 lbs. (15.9 kg.); 50 lbs. (27.1 kg.). Fuel 35 gals. (132.5 lit.). Oil 2.25 gals. (8.5 lit.).

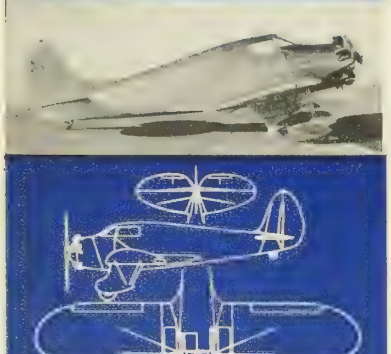
**Engine.** Kinner B-5, 125 h.p. at 1925 r.p.m.; Kinner K-5, 100 h.p. at 1810 r.p.m.

**Performance.** Maximum speed 112 m.p.h. (180.3 k.p.h.); 104 m.p.h. (167.4 k.p.h.). Cruising speed 100 m.p.h. (161 k.p.h.); 90 m.p.h. (144.8 k.p.h.). Landing speed 40 m.p.h. (64.4 k.p.h.). Service ceiling 15,000 ft. (4572 m.); 14,000 ft. (4267.2 m.). Climb per min. 900 ft. (274.3 m.); 800 ft. (243.8 m.). Cruising range 400 mi. (643.8 km.); 450 mi. (724.2 km.).

**Construction.** Fuselage: welded chrome molybdenum steel tubing; fabric covered; side-by-side seating with dual controls. Wing: spruce spars and ribs; fabric covered; double drag truss; Clark Y airfoil section; attached to short stubs built integral with fuselage and braced to top fuselage longeron. Tail group: welded chrome molybdenum steel tubing; fabric covered. Fully swivelling tail wheel.

**Standard equipment.** Story-Gawley wood propeller, Eclipse starter, Goodyear Airwheel tires and wheels, Goodrich Streamline tire, parking and taxiing brakes, oil and spring shock absorbers, battery, Grimes navigation lights, Pyrene fire extinguisher, first aid kit, non-shatterable windshield glass, chrome plated exhaust collector ring and tail pipe, adjustable seat, du Pont Fabrikoid upholstery, quadrant throttle controls.

**Instruments.** Kollsman altimeter, air speed indicator, compass; Pioneer tachometer, oil pressure and oil temperature gauges; Ford fuel gauge.




## KINNER R Playboy

2-place

**ATC 554**

**Specifications.** Span 32′ 8.37″ (10 m.). Length 24′ 3″ (7.4 m.). Height 7′ 9″ (2.4 m.). Wing area 189 ft.² (17.6 m.²). Power loading 14.2 lbs./h.p. (6.4 kg./h.p.). Wing loading 12 lbs./ft.² (58.6 kg./m.²). Weight empty 1481 lbs. (671.8 kg.). Useful load 789 lbs. (357.9 kg.). Payload 325 lbs. (147.4 kg.). Gross weight 2270 lbs. (1029.7 kg.). Baggage 155 lbs. (70.3 kg.). Fuel 44.5 gals. (168.5 lit.). Oil 3.5 gals. (13.2 lit.).

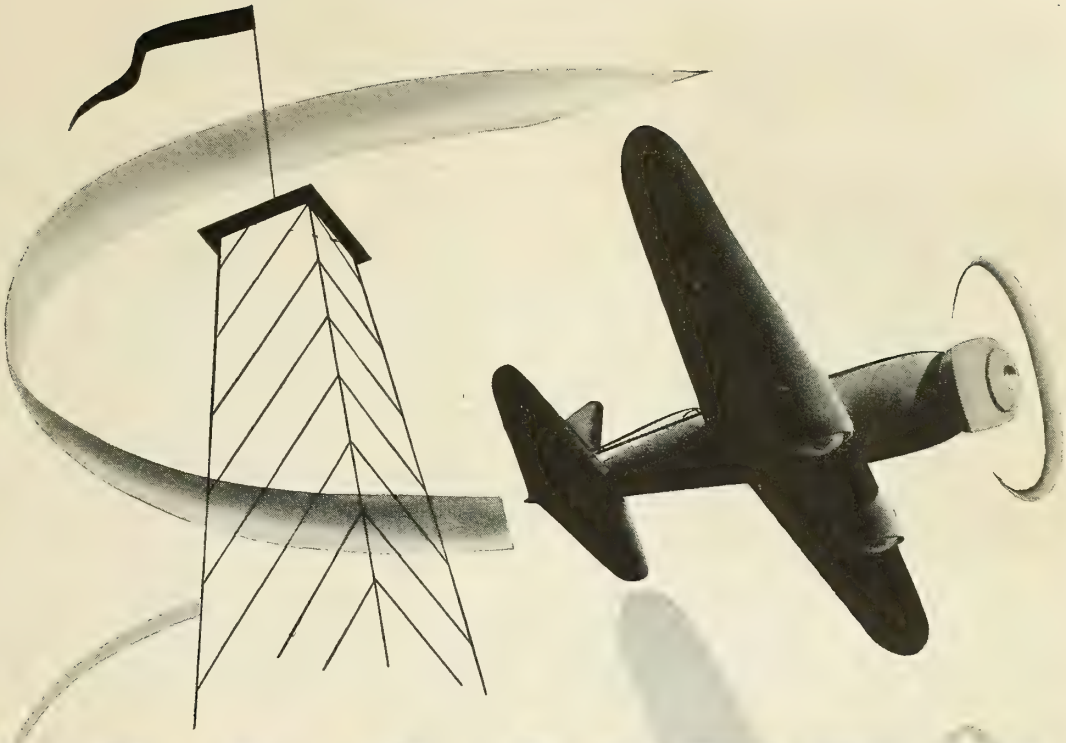
**Engine.** Kinner R-5 Series 2, 160 h.p. at 1850 r.p.m.

**Performance.** Maximum speed 140 m.p.h. (225.3 k.p.h.). Cruising speed 128 m.p.h. (206 k.p.h.). Landing speed 55 m.p.h. (88.5 k.p.h.). Service ceiling 15,000 ft. (4572 m.). Climb per min. 800 ft. (243.8 m.). Cruising range 580 mi. (933.5 km.).

**Construction.** Fuselage: welded chrome molybdenum steel tubing; fabric and metal covered; side-by-side seating arrangement with dual controls. Wing: spruce spars and ribs; fabric covered; wire braced; double drag truss construction; Clark Y airfoil section. Tail group: welded chrome molybdenum steel tubing; fabric covered; tabs on elevators; fixed stabilizer. Fixed type landing gear with two rigid Vees from the apices of which a short horizontal fork is hinged forward to take the wheels; shock absorber legs extend to top of front legs of the fixed Vees; each unit enclosed in streamlined fairings. Swivelling and steerable tail wheel.

**Standard equipment.** Hamilton Standard metal propeller, Eclipse starter, Goodyear 22×6.50-10 semi-airwheel, tires and wheels, Goodrich Streamline tail wheel tire, parking and taxiing brakes, oil and spring shock absorbers, Exide battery, Grimes navigation lights, friction quadrant throttle controls, Pyrene fire extinguisher, first aid kit, duPont Fabrikoid upholstery, non-shatterable cabin and windshield glass, Lord rubber engine mount.

**Instruments.** Kollsman altimeter, airspeed indicator, compass; Pioneer tachometer, oil pressure and oil temperature gauges; Ford fuel gauge.



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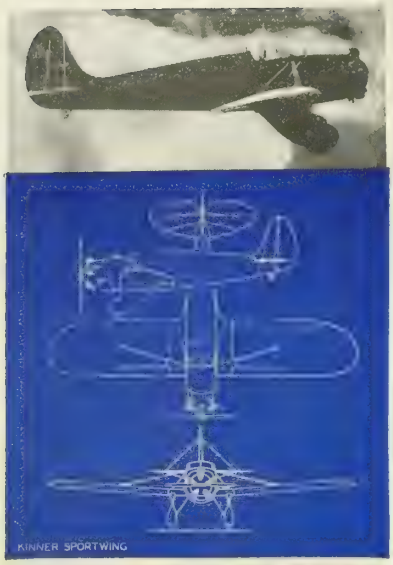
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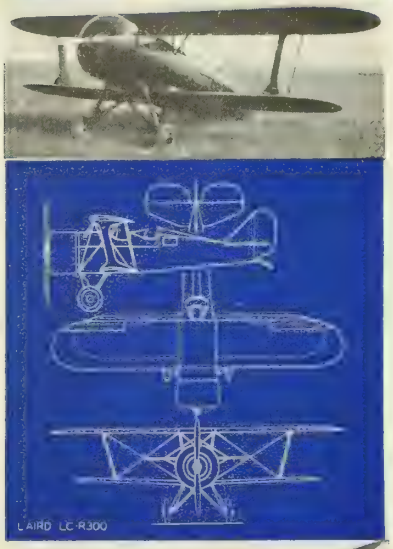



## KINNER Sportwing

2-place

**ATC 617**

**Specifications.** Span 34′ 5.5″ (10.5 m.). Length 24′ 6.5″ (7.5 m.). Height 7′ 2.5″ (2.2 m.). Wing area 199 ft.$^2$ (18.5 m.$^2$). Power loading 13.5 lbs./h.p. (6.1 kg./h.p.). Wing loading 10.9 lbs./ft.$^2$ (53.2 kg./m.$^2$). Weight empty 1397 lbs. (633.7 kg.). Useful load 773 lbs. (350.6 kg.). Payload 326 lbs. (147.9 kg.). Gross weight 2170 lbs. (984.3 kg.). Baggage 156 lbs. (70.8 kg.). Fuel 42 gals. (159 lit.). Oil 3.25 gals. (12.3 lit.).
**Engine.** Kinner R-5 Series 2, 160 h.p. at 1850 r.p.m.
**Performance.** Maximum speed 132 m.p.h. (212.4 k.p.h.). Cruising speed 120 m.p.h. (193.1 k.p.h.). Landing speed 45 m.p.h. (72.4 k.p.h.). Service ceiling 17,950 ft. (5470.2 m.). Climb per min. 1100 ft. (335.3 m.). Cruising range 510 mi. (820.8 km.).
**Construction.** Fuselage: welded chrome molybdenum steel tubing; fabric covered; side-by-side seating with dual controls. Wing: spruce spars and ribs; fabric covered; Clark Y airfoil, wing section attached to short stubs built integral with fuselage and braced to top fuselage longeron by inverted Vee struts. Frieze type differential ailerons; wing root faired. Tail group: welded chrome molybdenum steel tubing; fabric covered; empennage filleted; tabs on elevators; adjustable stabilizer. Fixed type landing gear. Steerable tail wheel.
**Standard equipment.** Story-Gawley wood propeller, General 22 × 6.50-10 tires, Goodrich streamline tail wheel tire, Autofan wheels, parking and taxiing brakes, oil and spring shock absorbers, battery, navigation lights, metal pants, Pyrene fire extinguisher, first aid kit, duPont Fabrikoid upholstery, non-shatterable windshield glass, adjustable seat, Lord rubber engine mounting, chrome plated exhaust collector ring, engine cowl, wheel type ball bearing tab control, baggage compartments, friction quadrant throttle controls.
**Instruments.** Kollsman altimeter, airspeed indicator, compass; Pioneer tachometer, oil pressure and oil temperature gauges, Ford fuel gauge; switch.

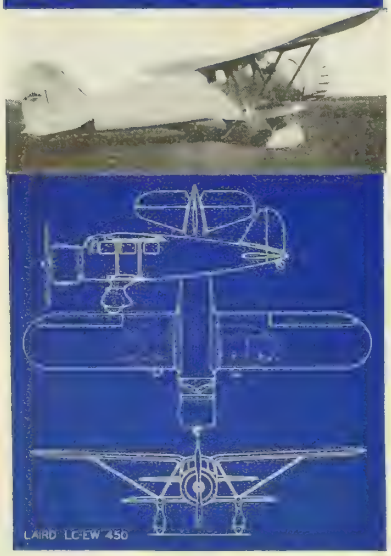



## LAIRD LC-R300

3-place

**ATC 176**

**Specifications.** Span 28′ (8.5 m.). Length 22′ 9″ (6.9 m.). Height 9′ (2.7 m.). Wing area 202 ft.$^2$ (18.8 m.$^2$). Power loading 10.3 lbs./h.p. (4.7 kg./h.p.). Wing loading 15.3 lbs./ft.$^2$ (74.7 kg./m.$^2$). Weight empty 1922 lbs. (871.8 kg.). Useful load 1088 lbs. (493.5 kg.). Payload 390 lbs. (176.9 kg.). Gross weight 3010 lbs. (1365.3 kg.). Fuel 76 gals. (287.7 lit.). Oil 8 gals. (30.3 lit.).
**Engine.** Wright Whirlwind R975-E rated 330 h.p. (A P & W Wasp Junior 300 h.p. engine can be substituted as the power plant in this plane, in which case the model is known as the LC-RW300.)
**Performance.** Maximum speed 175 m.p.h. (281.6 k.p.h.). Cruising speed 155 m.p.h. (249.5 k.p.h.). Landing speed 55 m.p.h. (88.5 k.p.h.). Service ceiling 20,000 ft. (6096 m.). Climb per min. 1500 ft. (457.2 m.). Cruising range 550 mi. (885.2 km.).
**Construction.** Fuselage: duralumin tubing trussed with tie rods; forward section metal covered to rear of pilot's cockpit, remainder fabric covered; tandem seating arrangement; two large baggage compartments directly aft of pilot's seat. Wings: solid spruce spars ribs of three-ply plywood, reinforced with spruce struts and spruce cap strips; fabric covered; solid spruce compression struts and tie rod drag bracing; interplane struts are solid plywood streamline I struts; ailerons independently controlled by push and pull tube system. Tail group: stabilizer, elevators, rudder and fin welded steel sheet and tubing, fabric covered; stabilizer adjustable from cockpit with vernier type control and indicator. Split axle type landing gear; brakes operated by Laird rudder-brake pedals, in which rudder and brake pedals are a unit.
**Standard equipment.** Hamilton Standard metal propeller, General Streamline tires, Bendix wheels and brakes, oleo shock absorbers, Exide battery, navigation lights, electric starter, dual controls.
**Instruments.** Compass, airspeed indicator, tachometer, turn and bank indicator, engine head temperature gauge, altimeter, oil pressure gauge, oil temperature gauge.



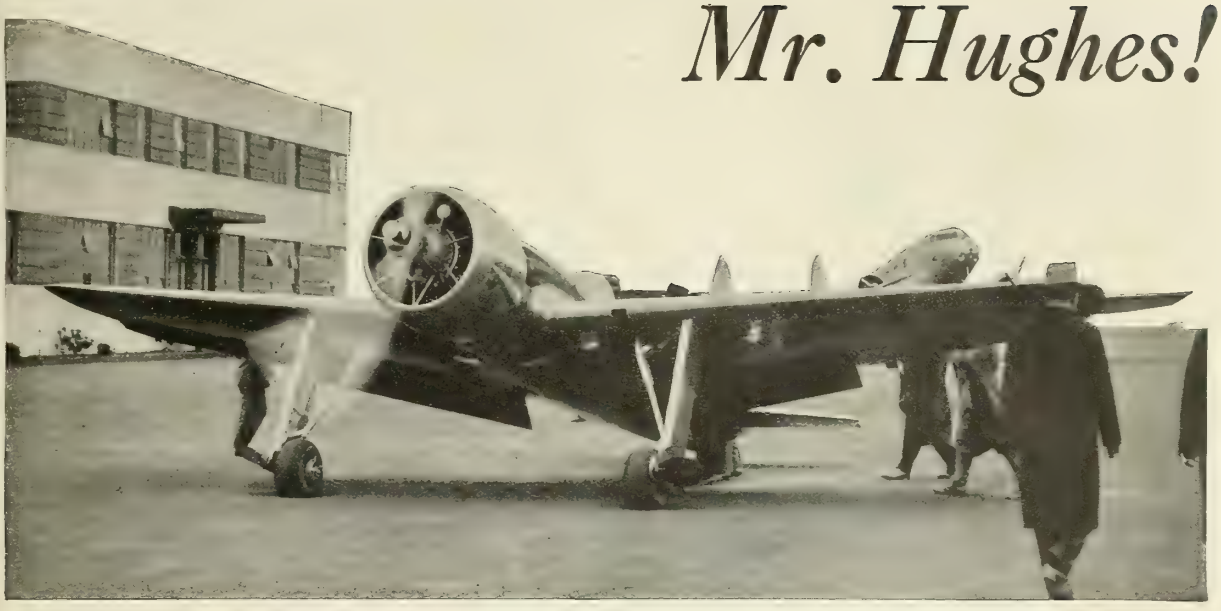

## LAIRD LC-EW 450

6-place

**EXP.**

**Specifications.** Span 38′ (11.6 m.). Length 27′ 6″ (8.4 m.). Height 8′ 8″ (2.6 m.). Wing area 250 ft.$^2$ (23.2 m.$^2$). Power loading 11.9 lbs./h.p. (5.4 kg./h.p.). Wing loading 21.3 lbs./ft.$^2$ (104 kg./m.$^2$). Weight empty 3205 lbs. (1453.8 kg.). Useful load 2145 lbs. (973 kg.). Payload 1170 lbs. (530.7 kg.). Gross weight 5350 lbs. (2526.8 kg.). Fuel 150 gals. (567.8 lit.). Oil 10 gals. (37.9 lit.).
**Engine.** P & W Wasp S1D1 rated 450 h.p.
**Performance.** Maximum speed 200 m.p.h. (321.9 k.p.h.). Cruising speed 175 m.p.h. (281.6 k.p.h.). Landing speed 58 m.p.h. (93.3 k.p.h.). Service ceiling 21,000 ft. (6400.8 m.). Climb per min. 1600 ft. (487.7 m.). Cruising range 850 mi (137 km.).
**Construction.** Fuselage: all-metal, 24S-T duralumin, semi-monocque construction; smooth skin outer covering 24S-T riveted to elliptical shaped bulkheads at wing root stations which are of two extruded bulb T-sections with a 17S-T web riveted between forming an I cross section. Wings: upper wing panels and outer tips of lower stub panels spruce and plywood construction, fabric covered; chrome molybdenum steel tubing for inner section of lower stub wings; all-metal 24S-T flaps extend across entire lower wing and fuselage. Tail group: all-metal cantilever; smooth skin covered; elevator provided with trim tab. Fixed divided type landing gear.
**Standard equipment.** Hamilton Standard controllable-pitch propeller, General Streamline tires, Bendix wheels and brakes, Cleveland Pneumatic shock absorbers, streamlined wheel pants, Fafnir bearings for plane controls, Exide battery, landing lights, radio, Wiley flares, cabin heater, lavatory equipment.
**Instruments.** Compass, airspeed indicator, altimeter, turn and bank indicator, Sperry gyro-horizon and directional gyro, rate of climb indicator, clock, ammeter, engine head temperature indicator, fuel pressure and oil pressure gauges, oil temperature gauge, voltmeter.
*Other data in Jan. 1935* AERO DIGEST.

# *Congratulations Mr. Hughes!*



Howard Hughes, movie producer and sportsman pilot, taxis in at Newark Airport, January 19, 1937, after hanging up a new trans-continental air mark of 7 hours, 28 minutes and 27 seconds. His average speed for the flight was 332 miles an hour. *The wings of this plane are covered with Wellington Sears HH Balloon Cloth.*

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The characteristics of some of these Wellington Sears fabrics are shown below:

| FABRIC | THREADS PER INCH | WEIGHT | BREAKING STRENGTH |
|---|---|---|---|
| **B*A*30** | 80 x 80 | 4 oz. per sq. yard | 80 lbs. per inch |
| **BB** | 104 x 104 | 3 oz. per sq. yard | 60 lbs. per inch |
| **HH** | 130 x 138 | 2 oz. per sq. yard | 40 lbs. per inch |

# WELLINGTON SEARS COMPANY

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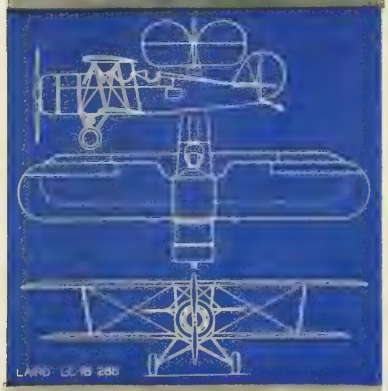
BOSTON PHILADELPHIA ATLANTA DETROIT CHICAGO ST. LOUIS NEW ORLEANS SAN FRANCISCO



## LAIRD LC-1B 285

3-place

**APPROVAL 2-501**




**Specifications.** Span 34′ (10.4 m.). Length 24′ 7″ (7.5 m.). Height 9′ 3″ (2.8 m.). Wing area 295 ft.² (27.4 m.²). Power loading 10.6 lbs./h.p. (4.8 kg./h.p.). Wing loading 10.2 lbs./ft.² (49.8 kg./m.²). Weight empty 1927 lbs. (874.1 kg.). Useful load 1108 lbs. (502.6 kg.). Payload 390 lbs. (176.9 kg.). Gross weight 3035 lbs. (1376.7 kg.). Fuel 85 gals (321.8 lit.). Oil 7 gals. (26.5 lit.).

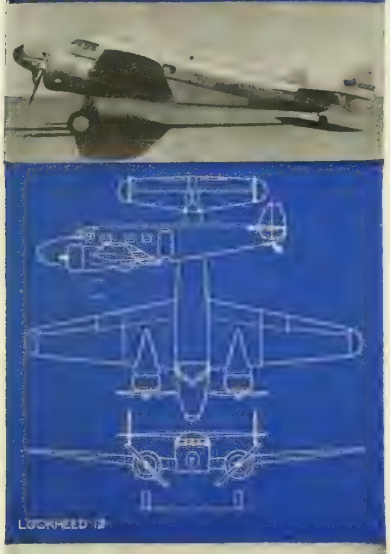
**Engine.** Wright Whirlwind R760E-1 rated 285 h.p. (Also available with Whirlwind 330 h.p. engine.)

**Performance.** Maximum speed 150 m.p.h. (241.4 k.p.h.). Cruising speed 135 m.p.h. (217.3 k.p.h.). Landing speed 45 m.p.h. (72.4 k.p.h.). Service ceiling 20,000 ft. (6096 m.). Climb per min. 1500 ft. (457.2 m.). Cruising range 600 mi. (965.6 km.).

**Construction.** Fuselage: duralumin tubing and tie rods, fabric covered; tandem seating arrangement; two large baggage compartments aft of pilot's seat. Wings: solid spruce spars; ribs of three-ply plywood, reinforced with spruce compression struts and rigid drag spruce struts and spruce capping strips; solid bracing; fabric covered; ailerons independently controlled by push-pull tube system. Tail group: fabric covered; spruce spars and ribs; elevators, rudder and fin welded steel tubing; stabilizer adjustable from cockpit by vernier-type hand-controlled unit with indicator. Landing gear divided axle type of wide tread. (The oleo type landing gear used on the Speedwing models can be supplied as optional equipment if preferred). Tail gear unit multiple steel leaf spring with 360° swivelling solid tire tail wheel.

**Standard equipment.** Hamilton Standard metal propeller, General Streamline tires, Bendix wheels and brakes, Exide battery, navigation lights, RCA radio, electric starter, dual controls, NACA cowl.

**Instruments.** Compass, airspeed indicator, tachometer, turn and bank indicator, engine head temperature gauge, rate of climb indicator, altimeter, oil pressure and oil temperature gauges, ice warning indicator.




## LOCKHEED 12

6 passengers—2 pilots

**ATC 618**

**Specifications.** Span 49′6″ (15.1 m.). Length 36′4″ (11.1 m.). Height 9′9″ (3 m.). Wing area 352 ft.² (32.8 m.²). Power loading 9.91 lbs./h.p. (4.5 kg./h.p.). Wing loading 22.5 lbs./ft.² (109.3 kg./m.²). Weight empty 5765 lbs. (2615 kg.). Useful load 2635 lbs. (1195 kg.). Variable payload. Gross weight 8400 lbs. (3810 kg.). Baggage 445 lbs. (200 kg.). Fuel 150 gals. (567 lit.). Oil 14 gals. (53 lit.).

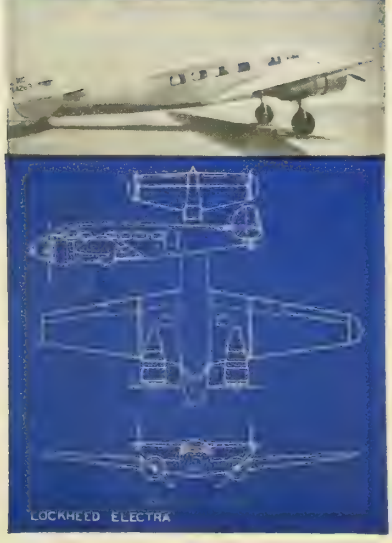
**Engines.** Model A: P & W Wasp Junior SB (two), 450 h.p. at 2300 r.p.m. Model B: Wright Whirlwind R975E-3, 420 h.p. at 2200 r.p.m.

**Performance.** Maximum speed 226 m.p.h. (364 k.p.h.). Cruising speed 213 m.p.h. (343 k.p.h.). Landing speed with flaps 64 m.p.h. (103 k.p.h.). Service ceiling 23,350 ft (7117 m.). Climb per min. 1700 ft. (518 m.). Cruising range 780 mi. (1255 km.).

**Construction.** Fuselage: all-metal Alclad 24S-T aluminum alloy, aluminum coated monocoque construction. Wing: all-metal, skin stressed with single shear beam; center section cut away at fuselage, permitting it to be placed partly within the wing. Split trailing edge flaps of metal construction, electrically operated. Tail group: all-metal; twin fin and rudder. Fully retractable landing gear. Fully swivelling tail wheel.

**Standard equipment.** Hamilton Standard controllable pitch propellers, General tires, Goodyear tail wheel tire, Hayes wheels, Cleveland Aerol shock absorbers, Exide battery, Grimes landing lights, navigation lights, Pyrene fire extinguisher, Elgin flares, Bauer & Black first aid equipment, American LaFrance engine fire extinguishers, shatterproof glass, soundproofing, ventilation and heating system, Eclipse starter, generator, booster coils, Lord rubber engine mountings, Pesco fuel pumps, Solar exhaust collector rings, Cuno oil filters, MoonGlo instrument panel lights, Western Electric two-way radio, individual passenger reading lights.

**Instruments.** Complete installation of flight and engine instruments of Pioneer, Weston, MotoMeter manufacture.




## LOCKHEED Electra

12-place

**ATCs 551-584-595**

Models 10A (10 passengers), 10B and 10E (10 passengers each); data given in that order.

**Specifications.** Span 55′ (16.8 m.). Length 38′ 7″ (11.8 m.). Height 10′ 1″ (3.1 m.). Wing area 458.3 ft.² (42.6 m.²). Power loading (lbs./h.p.) 12.62; 11.36; 11.67: (kg./h.p.) 5.7; 5.2; 5.3. Wing loading (lbs./ft.²) 22.04; 21.82; 22.91: (kg./m.²) 107.5; 106.5; 111.7. Weight empty (lbs.) 6325; 6300; 7100: (kg.) 2868; 2857; 3219. Useful load (lbs.) 3775; 3700; 3400: (kg.) 1712; 1678; 1543. Gross weight (lbs.) 10,100; 10,000; 10,500; (kg.) 4580, 4535; 4792. Baggage (lbs.) 670; 655; 422: (kg.) 305; 298; 191. Fuel (gals.) 160; 150; 135: (lit.) 605; 567; 510. Oil (gals.) 14; 14; 17: (lit.) 53; 53; 64.

**Engine.** P & W Wasp Jr. SB (two) 450 h.p. at 2300 r.p.m.; Wright Whirlwind R975E-3 (two) 440 h.p. at 2200 r.p.m.; P & W Wasp S3H1 (two) rated 550 h.p. at 2200 r.p.m.

**Performance.** Maximum speed (m.p.h.) 210; 200; 215; (k.p.h.) 339; 322; 346. Cruising speed (m.p.h.) 195; 186; 205: (k.p.h.) 314; 299; 330. Landing speed with flaps (m.p.h.) 64; 64; 65: (k.p.h.) 103; 103; 105. Service ceiling (ft.) 21,150; 18,200; 25,800: (m.) 6440; 5547; 7870. Climb per min. (ft.) 1100; 1230; 1200: (m.) 336; 375; 366. Cruising range (mi.) 810; 800; 830: (km.) 1305; 1287; 1340.

**Construction.** Fuselage: all-metal monocoque. Wing: all-metal with split-type trailing edge flaps. Tail group: all-metal.

**Standard equipment.** Hamilton Standard controllable pitch propellers, Goodyear airwheels, Cleveland Pneumatic shock absorbers, Exide battery, navigation and landing lights, Pyrene fire extinguishers, Elgin flares, Electrical Research Products soundproofing, Eclipse starter, shatterproof windshield and cabin enclosure.

**Instruments.** Complete airline installation including Kollsman, Pioneer, Weston, General Electric, Sperry and Scintilla manufacture. (AERO DIGEST, Aug. 1935, pg. 41).

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## LOCKHEED 14

11 passengers—3 crew

***EXP.**



*Plane now under construction.

**Specifications.** Span 65′6″ (19.9 m.). Length 44′.25″ (13.4 m.). Height 11′5.5″ (3.49 m.). Wing area 551 ft.² (51.2 m.²). Power loading 8.93 lbs./h.p. (4.05 kg./h.p.). Wing loading 27.2 lbs./ft.² (132.5 kg./m.²). Weight empty 9685 lbs. (4390 kg.). Useful load 5315 lbs. (2412 kg.). Variable payload. Gross weight 15,000 lbs. (6802 kg.). Baggage 340 lbs. (154 kg.). Fuel 460 gals. (1740 lit.). Oil 29 gals. (110 lit.).

**Engines.** Wright Cyclone geared GR-1820G-3 (two), 840 h.p. at 2100 r.p.m. up to 8700 ft. (2651.8 m.).

**Performance.** Maximum speed 265 m.p.h. (426 k.p.h.). Cruising speed 240 m.p.h. (386 k.p.h.) at 600 h.p. (1900 r.p.m.) up to 15,000 ft. (4572 m.). Landing speed with flaps 65 m.p.h. (105 k.p.h.). Service ceiling 26,300 ft. (8020 m.). Climb per min. 1700 ft. (518 m.). Cruising range 1000 mi. (1608 km.).

**Construction.** Fuselage: all-metal; monocoque; Alclad 24SR-T. Wing: all-metal; single spar, stressed skin. Lockheed-Fowler flap, all-metal, electrically operated. Integral fuel tanks with wing walls forming upper and lower surfaces of tank. Tail group: all-metal; statically and dynamically balanced elevators with trim tabs; dynamically balanced rudders with trim tabs. Partially retractable landing gear, hydraulically operated.

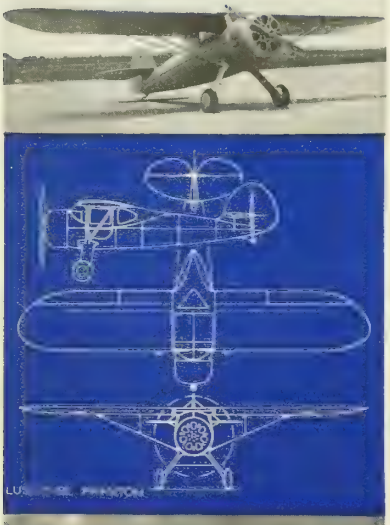
**Standard equipment.** Hamilton Standard constant speed propellers, Goodyear tires and wheels, Exide battery, Pyrene fire extinguishers, Elgin flares, Bauer & Black first aid equipment, Laidlaw upholstery, Plexiglas for windshield and cabin, Western Electric soundproofing, Eclipse starters, radio bonding and shielding.

**Instruments.** Kollsman altimeters, engine gauge unit, manifold pressure gauge, clock, tachometer, airspeed and rate of climb indicators, compass; Pioneer turn and bank indicator; Weston air temperature carburetor and oil temperature gauges, ammeter; Moto Meter fuel gauge; Sperry directional gyro and gyro-horizon; Lockheed wheel and flap position indicators.

## LUSCOMBE Phantom

2-place

**ATC 552**



**Specifications.** Span 31′ (19.45 m.). Length 20′10″ (6.35 m.). Height 6′8.5″ (2.04 m.). Wing area 143.25 ft.² (13.31 m.²). Power loading 13.42 lbs./h.p. (6.09 kg./h.p.). Wing loading 13.61 lbs./ft.² (6.18 kg./m.²). Weight empty 1320 lbs. (599 kg.). Useful load 630 lbs. (286 kg.). Payload 236 lbs. (107 kg.). Gross weight 1950 lbs. (885 kg.). Baggage 66 lbs. (30 kg.). Fuel 30 gals. (128 lit.). Oil 3.5 gals. (13.6 lit.).

**Engine.** Warner Super Scarab, 145 h.p. at 2050 r.p.m.

**Performance.** Maximum speed 163 m.p.h. (262 k.p.h.). Cruising speed 145 m.p.h. (233 k.p.h.). Landing speed with flaps 45 m.p.h. (73 k.p.h.); without flaps 55 m.p.h. (88 k.p.h.). Service ceiling 19,000 ft. (5800 m.). Climb per min. 1400 ft. (426 m.). Cruising range 560 mi. (900 km.).

**Construction.** Fuselage: monocoque; Alclad 17S-T; side-by-side seating arrangement; dual controls; baggage compartment behind seat, accessible in flight; seat cushions removable to allow use of seat-type parachute; large unobstructed door on each side of cabin. Wing: all-metal structure, fabric covered; extruded dural spars, stamped Alclad ribs; stainless steel shot welded split type flaps, manually or electrically operated. Tail group: Alclad fin and adjustable Alclad stabilizer; steel tube elevators and rudder; fabric covered. Fixed individual type landing gear. Licensed as seaplane on Edo floats.

**Standard equipment.** Curtiss-Reed fixed-pitch propeller, General tires, Hayes Autofan wheels and brakes, Luscombe oleo-spring shock absorbers, Reading battery, ball bearing engine and plane controls, Grimes navigation lights, landing lights, Pyrene fire extinguisher, first aid equipment, genuine leather upholstery, Pyralin windshield, safety glass for cabin, soundproofing, Eclipse starter, radio bonding and shielding; adjustable hot and cold ventilation.

**Instruments.** Pioneer altimeter, oil pressure and oil temperature gauges, tachometer, airspeed indicator, compass; ammeter; visual fuel gauges.

## MARTIN Model 130

46 passengers—6 crew

**ATC 585**



**Specifications.** Passenger compartment convertible into 18-berth sleeper. Span 130′ (39.6 m.). Length 90′ 7″ (27.6 m.). Height 24′ 7″ (7.5 m.). Wing area 2315 ft.² (215.1 m.²). Power loading 15.6 lbs./h.p. (7 kg./h.p.). Wing loading 22 lbs./ft.² (107.4 kg./m.²). Weight empty 24,611 lbs. (11,163.5 kg.). Useful load 26,389 lbs. (11,970 kg.). Variable payload. Gross weight 52,000 lbs. (23,587 kg.). Baggage 1610 lbs. (730.3 kg.). Fuel 4000 gals. (15,140 lit.). Oil 216 gals. (817.6 lit.).

**Engines.** P & W Twin Wasp S1A4G (four), rated 830 h.p. at 2400 r.p.m. at 6000 ft.

**Performance.** Maximum speed 180 m.p.h. (289.6 k.p.h.). Cruising speed 165 m.p.h. (265.5 k.p.h.) at 10,000 ft. (3048 m.) at 75% power. Landing speed 70 m.p.h. (112.6 k.p.h.). Service ceiling 17,000 ft. (5181.6 m.). Climb per min. 557 ft. (169.8 m.). Cruising range 3200 mi. (5149 km.).

**Construction.** Hull: semi-monocoque, aluminum alloy 24S-T throughout; riveted with 17S-T aluminum alloy rivets; 5 watertight compartments with watertight doors; two fuel tanks of 1900 gals. capacity integral with hull provided beneath flooring; corrugated bottom skin and deck covering, smooth side skin. Wings: externally braced center panel and internally braced cantilever outer panels of aluminum alloy 24S-T except fittings at concentrated load points which are heat treated alloy steel; box girder type primary structure with tension field web beams acting as side members. Seawings: 24S-T aluminum alloy riveted construction. Tail group: fin below stabilizer is integral with hull; upper fin, stabilizer, elevator and rudder aluminum alloy construction, fabric covered.

**Standard equipment.** Hamilton Standard controllable pitch propellers, Lord sheet mountings on instrument panel, Sperry soundproofing (AERO DIGEST, December, 1935).

**Instruments.** Complete airline installation of Sperry, Pioneer, Kollsman and General Electric manufacture. (AERO DIGEST, August 1935, pg. 41).




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**DEPT. A**

**WEST TRENTON NEW JERSEY**

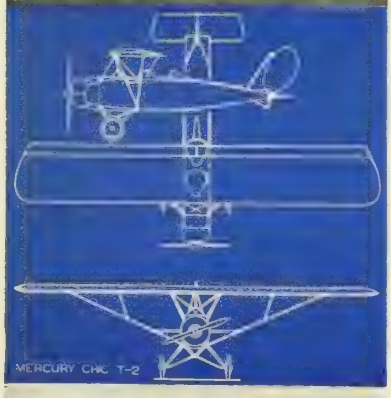
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## MARTIN 156 — 46 passengers—7 crew — *EXP.

*This model is now under construction.
**Specifications.** Passenger compartment convertible into 26-berth sleeper. Span 157′ (47.8 m.). Length 90′7″ (27.6 m.). Height 24′9″ (7.5 m.). Wing area 2290 ft.² (212.7 m.²). Power loading 18.2 lbs./h.p. (8.2 kg./h.p.). Wing loading 27.1 lbs./ft.² (132.3 kg./m.²). Weight empty 29,357 lbs. (13,316.3 kg.). Useful load 32,643 lbs. (14,806.9 kg.). Payload 9440 lbs. (4282 kg.). Gross weight 62,000 lbs. (28,123.2 kg.). Baggage 1380 lbs. (626 kg.). Fuel 3800 gals. (14,383 lit.). Oil 276 gals. (1044.6 lit.).
**Engines.** Wright Cyclone R1820G-2, 850 h.p. at 2100 r.p.m. at 5800 ft. (1767.8 m.).
**Performance.** (Estimated) Maximum speed 190 m.p.h. (305.7 k.p.h.). Cruising speed 160 m.p.h. (257.4 k.p.h.). Landing speed with flaps 70 m.p.h. (112.63 k.p.h.); without flaps 75 m.p.h. (120.7 k.p.h.).
**Construction.** Hull: semi-monocoque; aluminum alloy 24S-T throughout; riveted with A-17S aluminum alloy rivets; 5 watertight compartments with watertight doors; 4 fuel tanks integral with seawings; corrugated bottom skin and deck covering, smooth side skin. Wing: externally braced center panel and internally braced cantilever outer panels of aluminum alloy 24S-T except fittings at concentrated load points which are heat-treated alloy steel; box girder type primary structure with tension field web beams acting as side members. Seawings: 24S-T aluminum alloy riveted construction. Tail group: stub fin below stabilizer is integral with hull; fins, stabilizer aluminum alloy structure, metal covered; elevator and rudders aluminum alloy construction, fabric covered.
**Standard equipment.** Hamilton Standard constant speed propellers, Exide battery, ball bearings for engine controls, self-aligning bearings for flight controls, Pyle-National navigation lights, Grimes landing lights, Kidde fire extinguishers, Eclipse starters.
**Instruments.** Complete airline installation of instruments of Kollsman, Lewis, Pioneer, Liquidometer, General Electric, Weston, Sperry, Bowser and Cambridge manufacture.






## MERCURY Chic T-2 — 2-place — ATC 235

**Specifications.** Span 35′ 8″ (10.9 m.). Length 23′ (7 m.). Height 8′ 7″ (2.6 m.). Wing area 192 ft.² (17.8 m.²). Weight empty 935 lbs. (424.1 kg.). Useful load 578 lbs. (262.2 kg.). Payload 366 lbs. (166 kg.). Gross weight 1513 lbs. (686.3 kg.). Fuel 28 gals. (106 lit.). Oil 4 gals. (15 lit.).
**Engine.** LeBlond 90 h.p.
**Performance.** Maximum speed 115 m.p.h. (185.1 k.p.h.). Cruising speed 95 m.p.h. (152.9 k.p.h.). Landing speed 40 m.p.h. (64.4 k.p.h.). Service ceiling 18,000 ft. (5486.4 m.). Climb per min. 900 ft. (274.3 m.). Cruising range 375 mi. (603.5 km.).
**Construction.** Fuselage: welded chrome molybdenum steel tubing, fabric covered; tandem cockpits, with adjustable seats and dual controls. Wing: steel tubing; structure in two sections joined on the center line; strut supports utilized to brace the wing above the fuselage; Vee struts brace the wings to the bottom of the fuselage attaching to the bottom fuselage longerons; spars and ribs are of chrome molybdenum steel tubing; ailerons extend across the full width of the wing and are actuated by vertical tubes attached directly to the control stick, eliminating all cables and pulleys from the aileron system; flaps are of steel tubing, covered with fabric. Tail group: steel tube framework, fabric covered; the rudder post is braced to the top of the fuselage by two coverging steel tube struts; no stabilizer but balanced one-piece elevator; no fin, but balanced elliptical rudder; braced by steel tube struts to the horizontal knife-edge fuselage termination. Fixed split-type landing gear, consisting of two Vees hinged to the bottom fuselage longerons, and two half-axles, the inner ends of which are anchored to the apex of a steel-tube pyramid below the fuselage by a rubber cord shock absorber. Tail skid below rudder post.
**Standard equipment.** Hartzell wood propeller, 28 × 4 tires, Kelsey-Hayes wheels, navigation lights.
**Instruments.** Tachometer, altimeter, oil temperature gauge, oil pressure gauge.

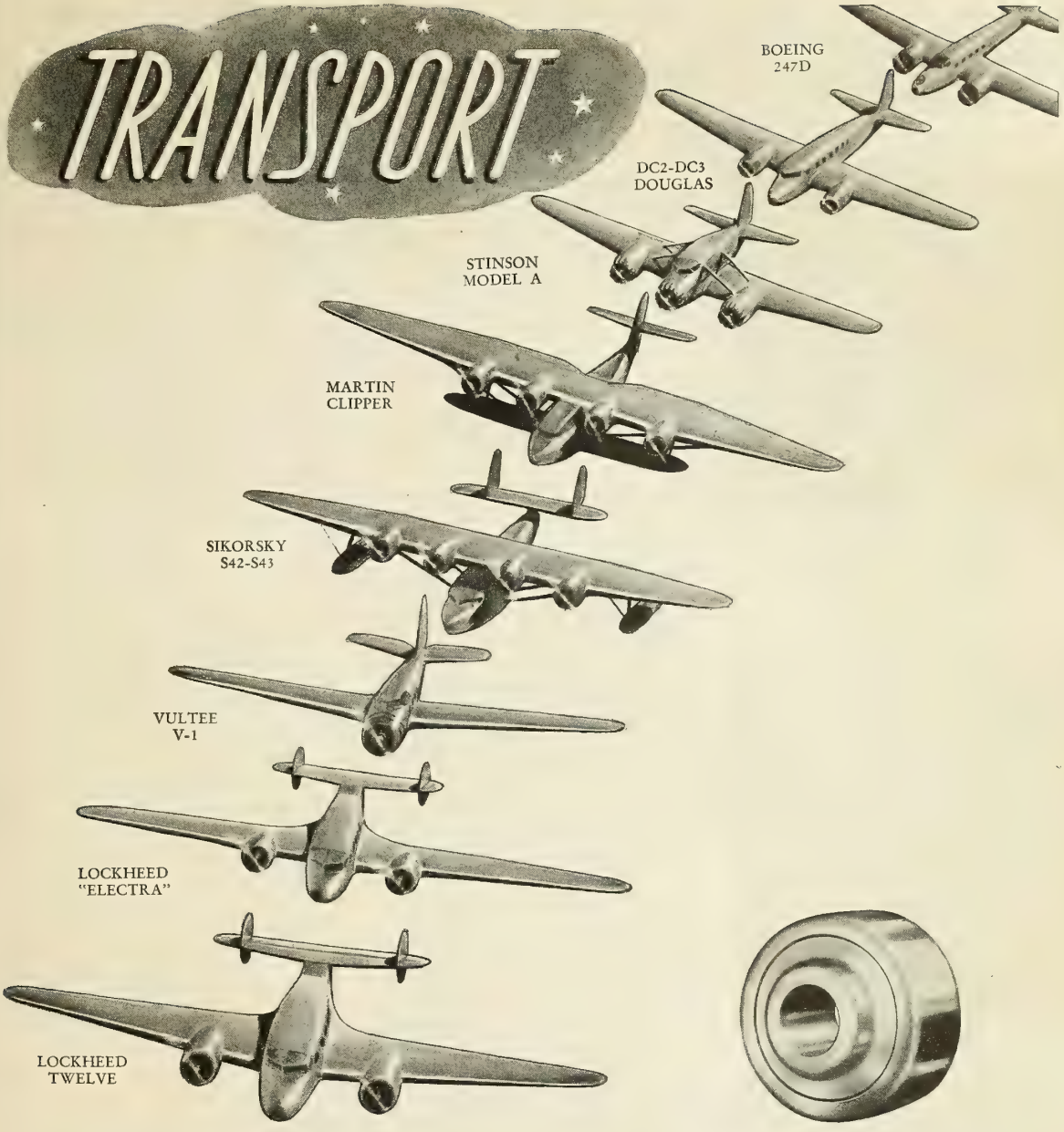





## MONOCOUPE Twin Monocoach Model H — 4-place — *ATC

*ATC pending.
**Specifications.** Span 36′ (11 m.). Length 24′ (7.3 m.). Height 7′ 10″ (2.4 m.). Wing area 231.2 ft.² (21.5 m.²). Power loading 17.89 lbs./h.p. (8.1 kg./h.p.). Wing loading 13.93 lbs./ft.² (67.9 kg./m.²). Weight empty 1882 lbs. (855 kg.). Useful load 1338 lbs. (605 kg.). Payload 710 lbs. (322 kg.). Gross weight 3220 lbs. (1460 kg.). Baggage 200 lbs. (91 kg.). Fuel 70 gals. (265 lit.). Oil 5 gals. (18.9 lit.).
**Engines.** Lambert R-266 (two), 90 h.p. at 2375 r.p.m.
**Performance.** Maximum speed 150 m.p.h. (242 k.p.h.). Cruising speed 135 m.p.h. (218 k.p.h.) at 8600 ft. (2620 m.); 125 m.p.h. (202 k.p.h.) at sea level. Landing speed with flaps 48 m.p.h. (77 k.p.h.); without flaps 55.5 m.p.h. (90 k.p.h.). Service ceiling 10,800 ft. (3280 m.). Climb per min. 560 ft. (182 m.) Cruising range 862 mi. (1385 km.)
**Construction.** Fuselage: welded steel tubing framework, metal covered to wing; fabric covered aft of wing leading edge. Wing: full cantilever construction; wood with fabric covering; two box spruce spars; beam type ribs; double drag bracing; box drag struts; NACA 2315 airfoil section; inset balanced ailerons of metal structure, fabric covered. Tail group: full cantilever; welded steel tubing; fabric covered; trim tabs on elevators; bungee on rudder. Balanced type flaps; metal structure; fabric covered. Fully retractable landing gear.
**Standard equipment.** Hamilton Standard propellers, Goodyear tires, wheels and hydraulic brakes, spring and oil oleo strut shock absorbers, storage battery, plain and ball bearing pulleys for controls, Pyle-National navigation lights, Fyr Fyter fire extinguisher, safety glass, Eclipse starter, bonding and shielding, heating and ventilation systems.
**Instruments.** Altimeter, manifold pressure gauge, clock, selective fuel gauge, tachometer, fuel pressure, oil pressure and oil temperature gauges, airspeed, turn and bank, rate of climb indicators, compass, wheel and flap position indicators.

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# FAFNIR BALL BEARINGS






## MONOCOUPE 90-A

2-place

**ATC 306**

**Specifications.** Span 32′ (9.8 m.). Length 20′6″ (6.3 m.). Height 6′11″ (2.1 m.). Wing area 132.3 ft.² (12.3 m.²). Power loading 17.6 lbs./h.p. (7.9 kg./h.p.). Wing loading 11.9 lbs./ft.² (58.1 kg./m.²). Weight empty 973 lbs. (441.3 kg.). Useful load 637 lbs. (288.9 kg.). Payload 286 lbs. (130 kg.). Gross weight 1610 lbs. (730.2 kg.). Baggage 116 lbs. (52.6 kg.). Fuel 28 gals. (106 lit.). Oil 2.5 gals. (9.5 lit.).
**Engine.** Lambert R-266, 90 horsepower at 2375 r.p.m.
**Performance.** Maximum speed 130 m.p.h. (209 k.p.h.). Cruising speed 110 m.p.h. (177 k.p.h.) at 2000 r.p.m. Landing speed with flaps 40 m.p.h. (64 k.p.h.); without flaps 45 m.p.h. (72.5 k.p.h.). Service ceiling 15,000 ft. (4572 m.). Climb per min. 900 ft. (274.3 m.). Cruising range 600 mi. (965 km.).
**Construction.** Fuselage: welded steel tubing; fabric covered; side-by-side seating arrangement; dual controls; baggage compartment. Wing: wood construction; fabric covered; two spruce spars, I beam type; ribs are bass wood webs and spruce cap strips, single drag bracing, solid drag struts; Clark Y wing section. Flaps trailing edge type extending from ailerons to fuselage; wood construction, fabric covered; manually operated. Tail group: welded steel tubing; fabric covered. Fixed type landing gear. Fully swivelling tail wheel. Also licensed by Dept. of Commerce as a seaplane on Edo model 1525 floats.
**Standard equipment.** Hamilton Standard propeller, NACA cowl, Goodrich 6.50 × 10 semi airwheels and brakes, Goodyear solid tail wheel tire; shock cord shock absorbers, Grimes landing lights, Shakespeare throttle controls, Fyr Fyter fire extinguisher, wheel pants, Johnson & Johnson first aid kit, cabin temperature control. Optional equipment includes Exide battery and Grimes retractable landing lights.
**Instruments.** Clock, magnetic compass, altimeter, airspeed indicator, tachometer, oil temperature indicator, oil pressure gauge.
*Other data in July, 1934,* AERO DIGEST.





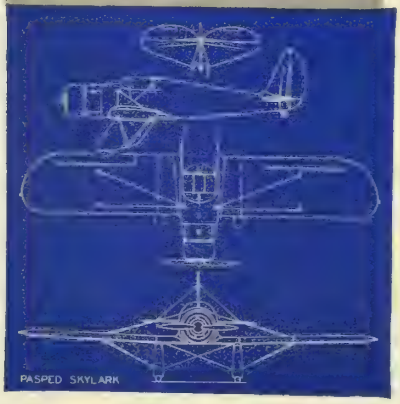

## NORTHROP Gamma

1-3-place

**ATC 549**

**Specifications.** Span 47.7′ (14.6 m.). Length 31.2′ (9.5 m.). Height 9′ (2.7 m.). Wing area 363 ft.² (33.7 m.²). Power loading 9.49 lbs./h.p. (4.6 kg./h.p.). Wing loading 20.25 lbs./ft.² (98.7 kg./m.²). Weight empty 4100 lbs. (1860 kg.). Useful load 3250 lbs. (1470 kg.). Gross weight 7350 lbs. (3330 kg.). Fuel 328 gals. (1240 lit.). Oil 21 gals. (80 lit.).
**Engine.** Wright Cyclone SR1820F-52, 775 h.p. at 2100 r.p.m. at 5800 ft. (1767.8 m.).
**Performance.** Maximum speed 223 m.p.h. (358 k.p.h.) at 6300 ft. (1920.2 m.). Cruising speed 204 m.p.h. (328 k.p.h.) at 2100 r.p.m. at 15,000 ft. (4572 m.) Landing speed with flaps 65 m.p.h. (104 k.p.h.) Service ceiling 23,400 ft. (7130 m.). Climb per min. 1390 ft. (424 m.). Cruising range 1970 mi. (3170 km.).
**Construction.** Fuselage: all-metal, aluminum alloy; semi-monocoque; center section of wing built integral with fuselage; sliding hood. Wing: all-metal, aluminum alloy; semi-monocoque, cantilever; multi-cellular construction; two outer panels separate from center section of wing. Flaps split trailing edge type, all-metal; hydraulically operated. Tail group: all-metal, aluminum alloy; semi-monocoque, cantilever; multi-cellular construction; balanced; trim tabs on rudder and elevators; fin and stabilizer fixed. Fully swivelling tail wheel.
**Standard equipment.** Hamilton Standard 2-position controllable-pitch propeller, 36 × 8 tires, mechanical brakes, oleo pneumatic shock absorber, wheel enclosures, navigation lights, landing lights, hand fire extinguisher, flares, starter, first aid equipment; ball bearings or roller bearings for engine and plane controls.
**Instruments.** Sensitive altimeter, air temperature gauge, thermocouple, manifold pressure gauge, clock, fuel, fuel pressure, oil pressure, oil temperature gauges, tachometer, ammeter, directional gyro, gyro-horizon, airspeed indicator, turn and bank indicator, rate of climb indicator, compass, carburetor temperature gauge, flap position indicator.






## PASPED Skylark

2-place

***ATC**

*ATC pending.
**Specifications.** Span 35′ 10″ (10.9 m.). Length 25′ (7.6 m.). Height 7′ 11″ (2.4 m.). Wing area 187 ft.² (17.4 m.²). Power loading 14.3 lbs./h.p. (6.5 kg./h.p.). Wing loading 9.56 lbs./ft.² (47 kg./m.²) Weight empty 1188 lbs. (538 kg.). Useful load 612 lbs. (277.8 kg.). Payload 230 lbs. (104.3 kg.). Gross weight 1800 lbs. (816.2 kg.). Baggage 60 lbs. (27.2 kg.). Fuel 31 gals (117 lit.). Oil 3.5 gals. (13.2 lit.).
**Engine.** Warner Scarab rated 125 h.p. at 2050 r.p.m.
**Performance.** Maximum speed 139 m.p.h (224 k.p.h.). Cruising speed 125 m.p.h. (201 k.p.h.) at 1900 r.p.m. Landing speed with flaps 35 m.p.h. (56.3 k.p.h.): without flaps 48 m.p.h. (77.4 k.p.h.). Service ceiling 19,000 ft. (5790 m.). Climb per min. 850 ft. (259 m.). Max. cruising range 650 mi. (1046 km.).
**Construction.** Fuselage: trussed type 4130 chrome molybdenum steel tubing; forward portion covered with 17 S-T dural; rearward portion aft of baggage compartment, fabric covered. Wing: laminated spruce spars; trussed spruce ribs; leading edge plywood covered; double drag bracing; center section dural 17 S-T covered, balance fabric covered. All-metal flap under center section manually operated. Tail group: chrome molybdenum; semi-cantilever; fabric covered; trim tabs on elevators. Swivelling tail wheel.
**Standard equipment.** Goodrich 6.50 × 10 tires, Goodyear tail wheel tire, Autofan wheels and brakes, oil-spring shock absorbers, Exide battery, Fafnir ball and bronze bearings, Pyle-Natl. navigation lights, Shakespeare throttle controls, Fahlin propeller, Pyrene fire extinguisher, Bauer & Black first aid equipment, Pyralin cabin enclosure and windshield, Eclipse starter, Lord shock mounting for instrument panel, glove compartment in instrument panel, indirect lighting.
**Instruments.** Kollsman altimeter, oil pressure and oil temperature gauges, airspeed indicator, tachometer, compass; Pasped electric flap position indicator, fuel gauge.

★ ★ ★ ★ ★ ★ ★



★ ★ ★ ★ ★ ★ ★

# HERE ARE ECONOMY ★ PERFORMANCE ★ SATISFACTION

"MY WORK as Consulting Engineer in oil refining requires frequent visits to various refineries. Among the places usually visited are Buffalo, Philadelphia, Pittsburgh, Cincinnati, Toledo, Chicago, Joliet, Wichita, Tulsa, Dallas, Houston, Fort Worth and Amarillo. The nature of my work does not require travel by plane but, knowing the saving to be obtained when compared to railroad transportation, I chose to personally finance the plane and save the difference in transportation cost. Below you will find an itemized statement of cost for the two years of operation of my Monocoupe.

| 900 Flying Hrs. Average Cruising Speed | 100,800 MILES* 112 miles per hour | | |
|---|---|---|---|
| | Total Cost 2 years | Cost Per Hr. | Cents Per Mi. |
| Gasoline (4,275 Gals. @ 22¢) | 940.50 | 1.04 | 0.93 |
| Oil (648 Quarts @ 35¢) | 226.80 | 0.25 | 0.22 |
| Storage (731 days @ $1.00) | 731.00 | 0.81 | 0.73 |
| Engine Checks (36 @ $7.00) | 252.00 | 0.28 | 0.25 |
| Major overhaul on engine | 100.00 | 0.11 | 0.10 |
| Top overhaul on engine | 25.00 | 0.03 | 0.02 |
| Spark Plugs | 40.00 | 0.04 | 0.04 |
| Propeller inspections | 30.00 | 0.03 | 0.03 |
| Windshield & window replacements | 30.00 | 0.03 | 0.03 |
| Incidentals | 100.00 | 0.11 | 0.10 |
| TOTAL COST OF OPERATIONS | $2,475.30 | 2.75 | 2.45 |
| Depreciation | 1,485.00 | 1.65 | 1.47 |
| Insurance | 650.00 | 0.72 | 0.64 |
| | $2,135.00 | 2.37 | 2.11 |
| GRAND TOTAL | $4,510.30 | 5.12 | 4.56 |

"Being a contractor, naturally my work is scattered around the country. Besides being a convenience, my Monocoupe is really the most economical manner in which I can travel. Several months ago it was necessary for me to make a trip of 1520 miles. The average flying time was 106 miles per hour with a gasoline mileage average of slightly better than 23 miles to the gallon."

**Names of above owners supplied on request*

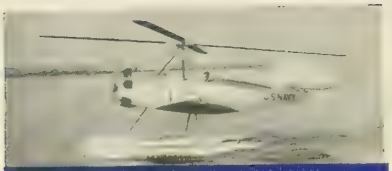
FOR years Monocoupe has been recognized for its outstanding performance and economy. This year, as before, we continue to give the most in the way of performance and achievement for the amount of money invested.

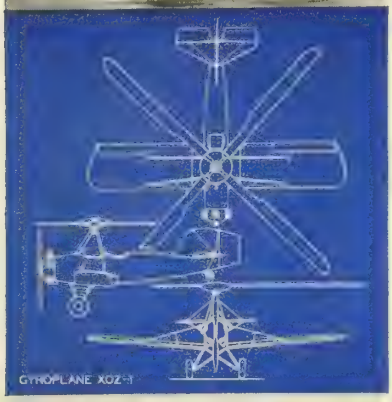


WE ARE about ready to present an outstanding contribution to private flying—the Twin Monocoach. We will shortly have completed all tests, and an announcement will be made at the time we are prepared to accept orders for this machine.

The Monocoupe

**MONOCOUPE CORP.** **LAMBERT FIELD, ROBERTSON, MO.**





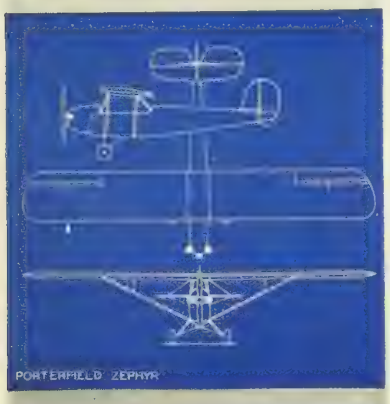

## PENNSYLVANIA Gyroplane XOZ-1

2-place

EXP

**Specifications.** Rotor diameter 32′ (9.7 m.). Span of fixed wing 27′ 4″ (8.3 m.). Length 21′ 4″ (6.5 m.). Height 10′ (3 m.). Tread 67.5″ (1.7 m.). Fixed wing area 110 ft.² (10.2 m.²). Chord 55″ (1.4 m.). Rotor disk area 804 ft.² (74.7 m.²). Rotor blade area 68.3 ft.² (6.3 m.²). Power loading 12.8 lbs./h.p. (5.8 kg./h.p.). Wing loading 18 lbs./ft.² (87.9 kg./m.²). Rotor disk loading 2.47 lbs./ft.² (12 kg./m.²). Weight empty 1455 lbs. (660 kg.). Useful load 530 lbs. (240.4 kg.). Gross weight 1985 lbs. (900.4 kg.). Fuel 16 gals. (60.6 lit.). Oil 3 gals. (11.3 lit.).
**Engine.** Kinner R-5, 155 horsepower at 1975 r.p.m.
**Performance.** Maximum speed 107 m.p.h. (172.2 k.p.h.). Cruising speed 90 m.p.h. (144.8 k.p.h.). Landing speed 30 miles per hour (48.3 k.p.h.). Cruising range 148 mi. (238.2 km.).
**Construction.** Fuselage: welded chrome molybdenum steel tubing; fabric covered; tandem seating arrangement. Wing: wood spars dural ribs; fabric covered; strut braced to fuselage; blades of rotor re strained at hub both in horizontal and ver tical planes and are free to twist, o feather, only; opposite blades of the four bladed rotor are connected rigidly together so that as the angle of attack on one sid increases, that on the other side decreases blade angles controlled laterally and long tudinally by motion of control stick whic also controls ailerons and elevators. Ta group: steel tubing; fabric covered; wir braced to bottom fuselage longerons. Full swivelling tail wheel.
**Standard equipment.** Metal propeller, 7.50 × 10 Goodrich tires, Autofan wheels an brakes, Fleet shock absorbers, Norma-Hofi mann and SKF bearings for rotor and plan controls.
**Instruments.** Engine tachometer, rotor tach ometer, altimeter, airspeed indicator, o pressure gauge, oil temperature gauge.
*Other data in Feb., 1932, and Feb., 193* AERO DIGEST.






## PORTERFIELD Zephyr

2-place

APPROVAL

**Specifications.** Span 34 feet 8 inches (10.6 meters). Length 21 feet 7.5 inches (6.6 meters). Height 6 feet 11.25 inches (2.1 meters). Wing area 169 square feet (15.7 square meters). Power loading 26 pounds per horsepower (11.8 kilograms per horsepower). Wing loading 6.17 pounds per square feet (30.1 kilograms per square meter). Weight empty 578 pounds (263 kilograms). Useful load 462 pounds (209 kilograms). Payload 220 pounds (100 kilograms). Gross weight 1040 pounds (472 kilograms). Baggage allowance 10 pounds (4.5 kilograms). Fuel 9 gallons (34.1 liters). Oil 1 gallon (3.78 liters).
**Engine.** Continental A40-4, 40 h.p. at 2575 r.p.m.
**Performance.** Maximum speed 85 m.p.h. (136.7 km./hr.). Cruising speed 75 m.p.h. (120.5 km./hr.). Landing speed 35 m.p.h. (56.2 km./hr.). Service ceiling 9000 ft. (2740 m.). Climb per min. 425 ft. (130 m.). Cruising range 225 mi. (362 km.).
**Construction.** Fuselage: welded chrome molybdenum steel tubing, Warren truss type tandem seating arrangement with removabl dual controls; baggage compartment acces sible in flight; fuselage fabric covered. Wing spruce spars, built-up ribs, fabric covered strut braced by streamlined steel tubes o either sides of fuselage. Tail group: chrom molybdenum steel tubing, welded; fabric cov ered; stabilizer adjustable in flight fro cockpit; wire braced to fuselage by Mac whyte tie rods. Fixed split type landing gea Tail skid.
**Standard equipment.** Fahlin or Sensenic wood propeller, Goodyear tires, Goodyea wheels, Goodyear rubber disk shock ab sorbers, plain engine and plane control bea ings, Pyrene fire extinguisher, first ai equipment, Pyralin windshield and cabi enclosure.
**Instruments.** Zenith aneroid altimeter; floa type fuel gauge; U. S. oil pressure and o temperature gauges; Jones centrifugal typ tachometer; connection for pitot static ai speed indicator.






## PORTERFIELD 35

2-place

*ATC

Models 35-V; 35-70; 35-90; data given in that order. *ATCs 606, 567, 611.
**Specifications.** Span 32′ (9.8 m.). Length 20′ (6.1 m.). Height 6′ 7″ (2 m.). Wing area 147 ft.² (13.6 m.²). Power loading (lbs./h.p.) 20.2; 18.7; 14.7; (kg./h.p.) 9.2; 8.5; 6.7. Wing loading (lbs./ft.²) 8.9; 8.9; 9; (kg./m.²) 43.4; 43.4; 43.9. Weight empty (lbs.). 813; 813; 823: (kg.) 369; 369; 373. Useful load 497 lbs. (225 kg.). Payload 200 lbs. (90.8 kg.). Gross weight (lbs.) 1310; 1310; 1326; (kg.) 595; 595; 601. Baggage 30 lbs. (13.6 kg.). Fuel 18 gals. (68.1 lit.). Oil (gals.) 2.5; 2.5; 3; (lit.) 9.5; 9.5; 11.4.
**Engine.** Lambert Velie M-5, 65 h.p. at 2000 r.p.m.; LeBlond 5-E, 70 h.p. at 1950 r.p.m.; Warner Scarab 90 h.p. at 2025 r.p.m.
**Performance.** Maximum speed (m.p.h.) 112; 115; 122; (k.p.h.) 180; 185; 195. Cruising speed (m.p.h.). 103; 105; 112; (k.p.h.) 166; 169; 180. Landing speed 40 m.p.h. (64.4 k.p.h.). Service ceiling (ft.) 15,000; 15,000; 20,000; (m.) 4580; 4580; 6100. Climb per min. (ft.) 600; 600; 1050; (m.) 183; 183; 320. Cruising range (mi.) 375; 360; 33( (k.p.h.) 605; 579; 540.
**Construction.** Fuselage: welded chrome molyb denum steel tubing, Warren truss type tandem seating arrangement; removable du controls; baggage compartment, 18″ × 2( × 23″ with large door and accessible flight. Wing: spruce spars; built-up ribs fabric covered. Tail group: chrome molyb denum welded steel tubing, fabric covered.
**Standard equipment.** Fahlin wood propelle Goodyear tires and wheels, Rusco shoc cord rings, Pyrene fire extinguisher, L. ( Chase artificial leather upholstery, Pyrali windshield and cabin enclosure. Optiona equipment includes Goodyear mechanica brakes, Grimes navigation lights. Model 9 also includes as standard equipment brake to both seats, tail wheel, compass, speed rin and navigation lights.
**Instruments.** Aneroid altimeter; float-type fue gauge; U. S. oil pressure and oil temperatur gauges; Pioneer centrifugal-type tachometer pitot-static type airspeed indicator.



# THESE PORTERFIELD AIRPLANES WILL MAKE MONEY FOR YOU

POWER RANGE AND PRICE SELECTION

MODEL 90

Warner 90 hp. engine

(A. T. C. 611)

Top speed . . . . . 121 mph.
Cruising speed . . . . . 112 mph.
Landing speed . . . . . 40 mph.
Cruising radius . . . . . 336 miles
Climb . . . 1000 ft. in 57 seconds (fully loaded)

De luxe equipment, in addition to that of Model 70, includes brakes, tail wheel, speed ring, navigation lights.

PRICE $2,895

($965.00 down payment)

MODEL 70

LeBond 70 hp. engine

(A. T. C. 567)

Top speed . . . . . 115 mph.
Cruising speed . . . . . 105 mph.
Landing speed . . . . . 40 mph.
Cruising radius . . . . . 360 miles

Equipment includes extra instruments, wiring for navigation lights, etc. Cabin upholstered in red Spanish Dura leather.

PRICE $2,095

($698.35 down payment)

CONVENIENT TIME PAYMENTS ON ALL MODELS

NEW avenues of revenue are opening up, and old sources rapidly expanding, for individuals and operators whose minds are alert to the new possibilities of aircraft operation—with equipment they can buy and operate economically.

As manufacturers of low-cost aircraft we have made a study over a period of years, of training and miscellaneous aircraft operations. In our files are the records and correspondence of men who —with the small investment required for PORTERFIELD aircraft—are earning incomes usually associated with businesses of relatively large capital investment.

These are the records of men who bought wisely. Their earnings are possible primarily because they did not tie up unnecessary thousands of dollars in heavy equipment—and burden themselves with operating and maintenance expenses amounting to several dollars an hour.

To established flying schools operating several aircraft . . . to individuals giving instruction and doing passenger work . . . to flying clubs—we say, study the PORTERFIELD record, examine the PORTERFIELD planes, *fly* the PORTERFIELD planes before you buy. And to private fliers interested in aircraft for sport, unless you're determined to spend several thousand dollars for larger equipment, we say you'll be more than pleased with PORTERFIELD performance, style and comfort.

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## PORTERFIELD AIRCRAFT CORP.

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## *and in the light plane class . . . .* The ZEPHYR

Government approved. Powered by the dependable 40 hp. Continental engine. Top speed 85 mph. Cruising speed 75 mph. Landing speed 30 mph. Cruising radius 250 miles. Available with open cockpit; or as a cabin airplane. Actual tests show remarkable fuel economy—only 55c for 75 miles of flight. Standard colors, Porterfield Red with Insignia Blue trim.

AS AN OPEN PLANE

PRICE $1,295

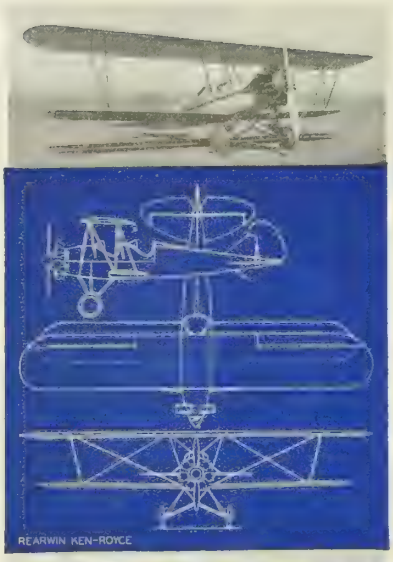
($431.65 down payment)

AS A CABIN PLANE

PRICE $1,355

($451.65 down payment)

*Export Representative: Aviation Equipment & Export, Inc. 25 Beaver St., New York, N. Y., U. S. A. Cable Address: "AVIQUIPO"*




## REARWIN 2000C and C-O Ken-Royce 3-place ATCs 232-314

Models 2000C and 2000C-O; data given in that order.

**Specifications.** Span 35′ (10.7 m.). Length 25′ (7.6 m.). Height 9′ 11″ (3 m.). Wing area 300 ft.² (27.9 m.²). Power loading 12.81 lbs./h.p. (5.8 kg./h.p.). Wing loading 7.09 lbs./ft.² (34.6 kgs./m.²). Weight empty 1495 lbs. (678.1 kg.). Useful load 885 lbs. (401.4 kg.). Payload 355 lbs. (161 kg.). Gross weight 2380 lbs. (1079.6 kg.). Fuel 55 gals. (208 lit.). Oil 5 gals. (18.9 lit.).

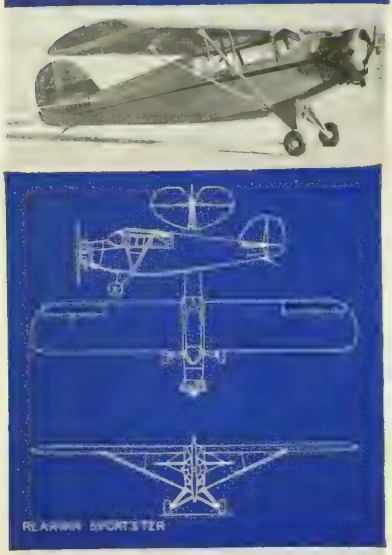
**Engine.** Curtiss Challenger, 185 h.p. at 2000 r.p.m.; Continental R670, 170 h.p. at 2000 r.p.m.

**Performance.** Maximum speed 140 m.p.h. (225.3 k.p.h.). Cruising speed 120 m.p.h. (193.1 k.p.h.) at 1800 r.p.m. Landing speed 35 m.p.h. (56.3 k.p.h.). Service ceiling 22,600 ft. (6888.5 m.). Climb per min. 1000 ft. (304.8 m.). Cruising range 500 mi. (804.7 km.).

**Construction.** Fuselage: welded chrome molybdenum steel tubing; fabric and aluminum covered; one large cockpit with two seats in tandem; individual windshields, or a transparent coupé top may be provided; dual controls, easily removable. Wings: wood construction, fabric covered; spars of laminated spruce; leading edge of formed spruce covered with birch plywood; spruce and plywood ribs; center section is carried above the fuselage by struts, and outer sections are braced to the bottom fuselage longerons by parallel steel tubes. Tail group: welded chrome molybdenum steel tubing, fabric covered; adjustable stabilizer.

**Standard equipment.** Hamilton Standard metal propeller, Goodyear Airwheels, Bendix or Goodyear wheels and brakes, spring shock cord shock absorbers, Exide battery, navigation lights, Aero Supply throttle controls, Scintilla switch, Pyrene fire extinguisher, Johnson & Johnson first aid kit, Pyralin windshield, Eclipse starter (extra), dual controls.

**Instruments.** Pioneer altimeter, tachometer, compass, airspeed indicator, oil pressure and oil temperature gauges; Jaeger clock.




## REARWIN Sportster 2-place *ATC

Models 7000, 9000L, 9000; data given in that order. *ATCs 574; 591; 624.

**Specifications.** Span 35′ (7.6 m.). Length 22′3″ (6.8 m.). Height 6′9″ (2.1 m.). Wing area 166 ft.² (15.4 m.²). Power loading (lbs./h.p.) 20.8; 16.2; 16.2; (kg./h.p.) 9.4; 7.3; 7.3. Wing loading 8.8 lbs./ft.² (43 kg./m.²). Weight empty (lbs.) 853; 830; 861: (kg.) 386.9; 376.5; 390.5. Useful load (lbs.) 607; 630; 599: (kg.) 275.3; 285.7; 271.7. Payload 220 lbs. (99.8 kg.). Gross weight 1460 lbs. (662.2 kg.). Baggage 50 lbs. (22.7 kg.). Fuel 24 gals. (90.8 lit.). Oil 2 gals. (7.6 lit.).

**Engine.** LeBlond 5E, 70 h.p. at 1950 r.p.m.; LeBlond 5F, 90 h.p. at 2250 r.p.m.; Warner Scarab Jr. Series 50, 90 h.p. at 2050 r.p.m.

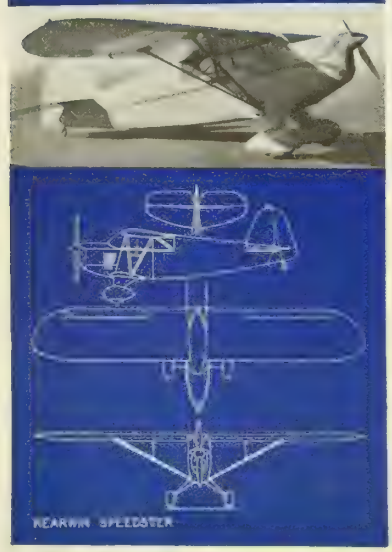
**Performance.** Maximum speed (m.p.h.) 115; 123; 120: (k.p.h.) 185.1; 198; 193.1. Cruising speed (m.p.h.) 103; 110; 107: (k.p.h.) 165.8; 177; 172.2. Landing speed 38 m.p.h. (61.1 k.p.h.). Service ceiling (ft.) 15,000; 17,000; 17,000: (m.) 4572: 5181.6; 5181.6: Climb per min. (ft.) 625; 1000; 900: (m.) 190.5; 304.8; 274.3. Cruising range 500 mi. (804.7 km.).

**Construction.** Fuselage: welded chrome molybdenum steel tubing; aluminum and fabric covered; tandem seating arrangement; dual controls; 2 baggage compartments. Wing: solid reinforced spruce spars; girder type spruce ribs; dural leading and trailing edge. Tail group: welded steel tubing; fabric covered; adjustable stabilizer and fin. Fixed landing gear. Tail wheel swivels through 180°.

**Standard equipment.** Fahlin propeller, Goodyear tires and wheels, hydraulic spring shock absorbers, Pyrene fire extinguisher, Pyralin windshield and cabin enclosure, Johnson & Johnson first aid equipment. Extra equipment includes Goodyear brakes, Reading battery, Grimes navigation lights, Eclipse starter, speed ring, carburetor heater, cabin heater.

**Instruments.** Aeromarine altimeter, oil pressure and oil temperature gauges, tachometer, Ford fuel gauge. Extra instruments include Kollsman compass.

*Other data in Feb., 1937,* Aero Digest.




## REARWIN Speedster 2-place EXP.

Models 6000M and 6000MS; data given in that order.

**Specifications.** Span 32′ (9.7 m.). Length 22′2″ (6.8 m.). Height 6′8″ (2 m.). Wing area 145 ft.² (13.8 m.²). Power loading 13.4 lbs./h.p. (6.1 kg./h.p.); 11.3 lbs./h.p. (5.1 kg./h.p.). Wing loading 11.5 lbs./ft.² (56.1 kg./m.²). Weight empty 1050 lbs. (476.3 kg.). Useful load 650 lbs. (294.8 kg.). Payload 220 lbs. (99.8 kg.). Gross weight 1700 lbs. (771.1 kg.). Baggage 50 lbs. (22.7 kg.). Extra equipment 50 lbs. (22.7 kg.). Fuel 34 gals. (128.7 lit.). Oil 2.5 gals. (9.5 lit.).

**Engine.** Menasco Pirate C4, 125 h.p. at 2175 r.p.m.; Menasco Pirate C4S, 150 h.p. at 2260 r.p.m.

**Performance.** Maximum speed 166 m.p.h. (267.2 k.p.h.); 200 m.p.h. (321.9 k.p.h.). Cruising speed 140 m.p.h. (225.3 k.p.h.); 165 m.p.h. (265.5 k.p.h.). Landing speed 48 m.p.h. (76.2 k.p.h.). Service ceiling 17,000 ft. (5181.6 m.); 18,500 ft. (5638.8 m.). Climb per min. 1000 ft. (304.8 m.); 1200 ft. (365.8 m.). Cruising range 600 mi. (965.4 km.).

**Construction.** Fuselage: welded chrome steel tubing; covered and faired with aluminum and fabric; tandem seating arrangement; dual controls; two baggage compartments. Wing: heavy solid reinforced spruce spars; spruce ribs; dural leading edge; welded steel tubing ailerons; aluminum alloy fuel tanks in wing; braced to bottom fuselage longerons by Vee struts. Tail group: welded steel tubing throughout; adjustable stabilizer and fin; fabric covered. Fixed cantilever type landing gear. Fully swivelling tail wheel.

**Standard equipment.** Fahlin wood propeller, 78″ diameter, 7.00 × 5 airwheel tires, Autofan mechanical brakes, shock cord shock absorbers, Fafnir ball bearing plane controls, Grimes navigation lights, Pyrene fire extinguisher, Johnson & Johnson first aid equipment, duPont Pyralin windshield and cabin enclosure, Eclipse starter, wheel pants.

**Instruments.** Aeromarine altimeter, oil pressure and oil temperature gauges, tachometer, airspeed indicator, compass; Ford fuel gauge.

*Other data in June,* 1935, Aero Digest.

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November 25, 1936

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## RYAN S-T

2-place

**ATCs 571-541**

Models S-T-A, S-T, and S-T-A-Special; data given in that order.

**Specifications.** Span 29′ 11″ (9.1 m.). Length 21′ 5.37″ (6.5 m.). Height 6′ 11″ (2.1 m.). Wing area 124 ft.² (11.5 m.²). Power loadings (lbs./h.p.) 12.6; 16.6; 12.6; (kg/h.p.) 5.7; 7.5; 5.7. Wing loading 12.7 lbs./ft.² (61.9 kg./m.²). Empty weight (lbs.) 1023; 1023; 1046: (kg.) 464; 464; 474.4. Useful load (lbs.) 552; 552; 529: (kg). 251; 251; 240. Payload 210 lbs. (95 kg.). Gross weight 1575 lbs. (714 kg.). Baggage 40 lbs. (18 kg.). Fuel 24 gals. (91 lit.). Oil 2 gallons (7.6 liters).

**Engine.** Menasco C4, 125 h.p. at 2175 r.p.m.; Menasco B4, 95 h.p. at 2000 r.p.m.; Menasco C4S, 150 h.p. at 2260 r.p.m. at 2000 ft. (609.6 m.).

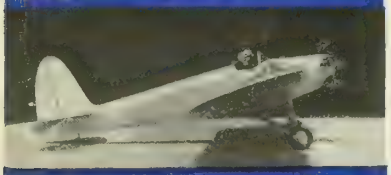
**Performance.** Maximum speed (m.p.h.) 150; 140; 160: (k.p.h.) 241; 225; 257. Cruising speed (m.p.h.) 127; 120; 135: (k.p.h.) 204; 193; 217. Landing speed with flaps 42 m.p.h. (68 k.p.h.); without flaps 48 m.p.h. (77 k.p.h.). Service ceiling (ft.) 17,500; 15,500; 21,000: (m.) 5330; 4720; 6410. Climb per min. (ft.) 1200; 800; 1400: (m.) 366; 244; 427. Cruising range (mi.) 350; 400, 350: (km.) 563; 643; 563.

**Construction.** Fuselage: all-metal, 24S-T; monocoque, tandem seating in open cockpits; dual controls. Wing: spruce spars; 24S-T Alclad ribs; fabric covered; NACA 2412 airfoil section. Flaps metal construction, fabric covered; manually operated. Tail group: riveted 24S-T Alclad; trim tabs on elevators. Fixed type landing gear. Fully swivelling tail wheel.

**Standard equipment.** Fahlin propeller, Goodyear tires, wheel and mechanical brakes, Cleveland Pneumatic Aerol shock absorbers, Pyrene fire extinguisher, Johnson & Johnson first aid equipment, Pyralin windshields, wheel pants, venturi type cowling, tail wheel swivel lock.

**Instruments.** Aeromarine altimeter, fuel pressure, oil pressure and oil temperature gauges, tachometer, airspeed indicator, compass; fuel gauges; Dayton throttles.





## SECURITY S-1B

2-place

**EXP.**

**Specifications.** Span 40′ (12.2 m.). Length 23′ 10″ (7.3 m.). Height 7′ (2.1 m.). Wing area 240 ft.² (22.3 m.²). Power loading 14.2 lbs./h.p. (6.6 kg./h.p.). Wing loading 6.75 lbs./ft.² (32.9 kg./m.²). Weight empty 1150 lbs. (521.8 kg.). Useful load 625 lbs. (283.6 kg.). Payload 485 lbs. (220 kg.). Gross weight 1775 lbs. (805.1 kg.). Baggage 145 lbs. (65.7 kg.). Fuel 23.5 gals. (88.9 lit.). Oil 3 gals. (11.3 lit.).

**Engine.** Security S1-125, 125 h.p. at 1900 r.p.m.

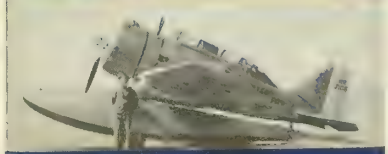
**Performance.** Maximum speed 120 m.p.h. (193.1 k.p.h.). Cruising speed 100 m.p.h. (160.9 k.p.h.). Landing speed 35 m.p.h. (56.3 k.p.h.). Service ceiling 18,000 ft. (5486.4 m.). Climb per min. 1200 ft. (365.8 m.). Cruising range 300 mi. (482.8 km.).

**Construction.** Fuselage: chrome molybdenum steel tubing, welded; fabric covered; side-by-side seating arrangement; dual controls; coupe enclosure; baggage compartment in fuselage aft of seats; engine mount can be swung around at 90°. Wing: spruce, solid routed spars; spruce ribs; fabric covered; folding type; outer panels attach to short stub center section braced to fuselage by a strut intended to transmit the oleo leg loads directly into the fuselage structure. Tail group: chrome molybdenum steel tubing, welded; fabric covered; adjustable stabilizer; wire bracing from trailing edges of stabilizer and fin. Fixed type landing gear. License as a seaplane on Edo model 1835 floats now pending with Department of Commerce. Fully swivelling tail wheel with solid rubber tire.

**Standard equipment.** Story or Standard Steel propeller, Goodrich 6.50 × 10 tires, Autofan wheels and brakes, Security shock absorbers, Willard storage battery, plain and ball bearings for engine and plane controls, Nicholas-Beazley navigation lights, Security throttle controls, Pyrene fire extinguisher, first aid equipment, electric starter, Plexiglas windshield and cabin enclosure.

**Instruments.** Pioneer altimeter, oil pressure and oil temperature gauges, tachometer, ammeter, airspeed indicator, compass.



## SEVERSKY SEV-2PA

2-place

**EXP.**

**Specifications.** Span 41′ (12.5 m.); alternate 36′ (11 m.). Length 30′5″ (9.26 m.). Height 10′9″ (3.28 m.). Wing area 250 ft.² (23.2 m.²); alternate 220 ft.² (20.45 m.²). Power loading 6.95 lbs./h.p. (3.16 kg./h.p.). Wing loading 23.6 lbs./ft.². (116 kg./m.²). Weight empty 4200 lbs. (1910 kg.). Useful load 1700 lbs. (773 kg.). Gross weight 5900 lbs. (2683 kg.). Fuel 160 gals. (606 lit.) (fuel load optional; standard design accommodates 200 or 350 gals.).

**Engine.** Wright Cyclone R1820G-2, 850 h.p. at 2100 r.p.m. at 5800 ft. (1767.8 m.).

**Performance.** Maximum speed 250 m.p.h. (403 k.p.h.). Cruising speed 220 m.p.h. (354 k.p.h.). Landing speed with flaps 68 m.p.h. (110 k.p.h.). Service ceiling 23,000 ft. (7000 m.). Climb per min. 2100 ft. (640 m.). Cruising range 850 mi. (1370 km.).

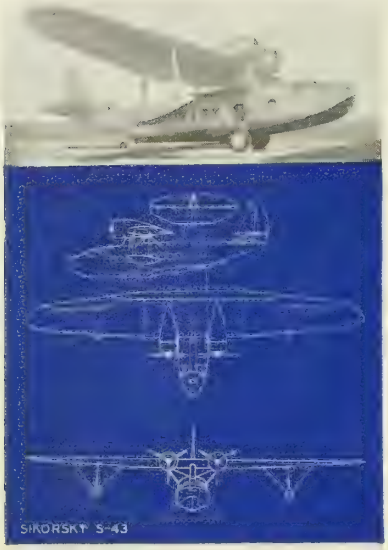
**Construction.** Amphibion. Fuselage: all-metal stressed skin, semi monocoque; continuous longitudinal stringers formed from 24S-T Alclad sheet and vertical bulkheads or former rings. Wing: all-metal, full cantilever, stressed skin construction; tapering in chord and thickness; attached to fuselage at 5 points on each side; 17S-T and 24S-T with steel used where necessary. All-metal flaps. Tail group: all-metal stressed skin construction; full cantilever; 24S-T Alclad.

**Standard equipment.** Hamilton Standard constant speed propeller, General tires, Hayes Autofan wheels, Bendix hydraulic brakes, Cleveland shock absorbers, Exide battery, Fafnir control bearings, Consolidated navigation lights, Adams & Westlake landing lights, Pyrene fire extinguisher, Wiley flares, Pittsburgh safety glass windshield, Plexiglas cabin enclosure, Eclipse starter.

**Instruments.** Pioneer altimeter, manifold pressure gauge, clock, tachometer, airspeed, turn and bank and rate of climb indicators; Kollsman sensitive altimeter, suction gauge; Weston ammeter-voltmeter, carburetor temperature gauge; Lewis thermocouple; Ashcroft engine gauge unit; fuel gauge; Sperry directional gyro; Breeze fuel-air mixture analyzer; wheel and flap position indicators.




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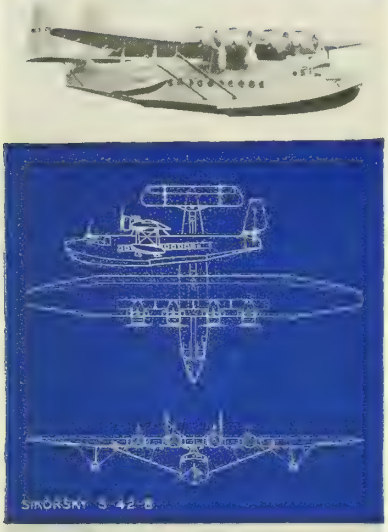



## SIKORSKY S-43

15 passengers—3 crew

**ATC 593**

**Specifications.** Span 86′ (26.2 m.). Length 51′ 2″ (15.6 m.). Height 17′ 8″ (5.4 m.). Wing area 780.6 ft.² (72.5 m.²). Power loading 13 lbs./h.p. (5.9 kg./h.p.). Wing loading 25 lbs./ft.² (121.9 kg./m.²). Empty weight 12,750 lbs. (5702 kg.). Useful load 6750 lbs. (3062 kg.). Payload 3243 lbs. (1471 kg.). Gross weight 19,500 lbs. (8845 kg.). Fuel 400 gals. (1514 lit.). Oil 28 gals. (106 lit.).
**Engines.** P & W Hornet S1EG geared (two), 750 h.p. each at 2250 r.p.m. at 7000 ft. (234 m.).
**Performance.** Maximum speed 190 m.p.h. (306 k.p.h.) at 7000 ft. (2134 m.). Cruising speed 166 m.p.h. (267 k.p.h.) at 7000 ft. (2134 m.) at 70% b.h.p. Landing speed 65 m.p.h. (105 k.p.h.). Service ceiling 19,000 ft. (5795 m.). Climb per min. 1000 ft. (300 m.). Cruising range 775 mi. (1248 km.).
**Construction.** Amphibion—Hull: all-metal, semi monocoque with stressed skin; protected against corrosion by anodic process; four main bulkheads with watertight doors divide hull into 5 separate watertight compartments. Wing: dural, semi-cantilever box spar type with stressed skin; fabric covered aft of rear spar and outboard of engines; construction in three separate panels having numerous continuous extruded flanges and heavy flush riveted surface covering; flaps all-metal, fabric covered; full length trailing edge type. Tail group: dural, fabric covered; adjustable stabilizer; balanced elevators and rudder. Fully retractable landing gear. Fully swivelling and retractable tail wheel. Converitable into flying boat by removing land gear equipment.
**Standard equipment.** Hamilton Standard constant speed propellers, Eclipse starters, General Streamline tires, Hayes wheels, Sikorsky hydraulic brakes and shock absorbers, Willard battery, Fafnir bearings, Grimes navigation lights, Pyrene fire extinguishers, International flares, Sperry soundproofing.
**Instruments.** Complete airline installation of Kollsman, Lewis, Pioneer, General Electric, Weston and Sperry products.
*Other data in July, 1935,* AERO DIGEST.

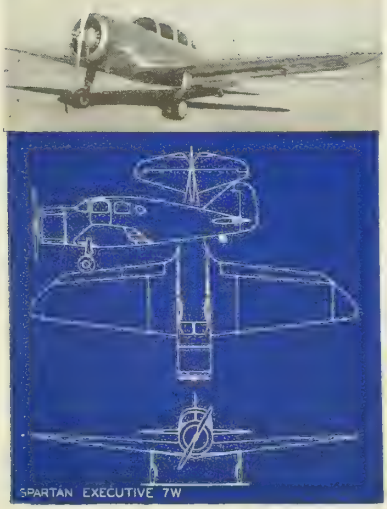



## SIKORSKY S-42-B

32 passengers—5 crew

**ATC 592**

**Specifications.** Passenger compartment convertible into 14-berth sleeper. Span 118′ 2″ (36 m.). Length 68′ (20.7 m.). Height (on land) 21′ 5″ (6.5 m.). Wing area 1340 ft.² (124.5 m.²). Power loading 14 lbs./h.p. (6.3 kg./h.p.). Wing loading 31.3 lbs./ft.² (153 kg./m.²). Empty weight fully equipped 24,000 lbs. (10,886 kg.). Useful load 18,000 lbs. (8165 kg.). Payload 9495 lbs. (4307 kg.). Gross weight 42,000 lbs. (19,051 kg.). Fuel 1240 gals. (4694 lit.). Oil 74 gals. (280 lit.).
**Engines.** P & W Hornet S1EG geared (four) 750 h.p. each at 2250 r.p.m. at 7000 ft. (2134 m.).
**Performance.** Maximum speed 188 m.p.h. (303 k.p.h.) at 7000 ft. (2134 m.). Cruising speed 163 m.p.h. (262 k.p.h.) at 7000 ft. (2134 m.) at 70% b.h.p. Landing speed 65 m.p.h. (105 k.p.h.). Service ceiling 15,500 ft. (4727 m.). Climb per min. 800 ft. (244 m.). Cruising range 1200 mi. (1932 m.).
**Construction.** Hull: two-step keel, long stern; 9 watertight compartments; duralumin shapes and sheet used throughout. Wing: two-spar construction with compression struts and stressed metal skin covering duralumin spars and ribs; differentially controlled balanced ailerons; flush riveted; TSM3 wing airfoil section. Flaps hydraulically controlled. Tail group: all-metal, fabric covered; elevator and rudders balanced.
**Standard equipment.** Hamilton Standard constant speed propellers, Exide battery, Fafnir bearings, Grimes navigation lights, G.E. landing lights, Pyrene and Kidde fire extinguishers, International flares, Sperry soundproofing, Eclipse starters, automatic mixture controls, engine synchronizer.
**Instruments.** Kollsman altimeter, air temperature, carburetor, temperature gauges; Pioneer compass, manifold pressure gauge, airspeed, turn and bank, rate of climb indicators; Sperry gyro-horizon, directional gyro; Weston ammeter-voltmeter; General Electric tachometers, oil pressure, fuel pressure and oil temperature gauges Nagel fuel gauges, Lewis thermocouples.
*Other data in April, 1934,* AERO DIGEST.




## SPARTAN Executive Model 7W

4-5-place

***ATC**

*ATC pending.
**Specifications.** Span 39′ (11.9 m.). Length 26′ 10″ (8.2 m.). Height 8′ (2.4 m.). Wing area 250.8 ft.² (23.4 m.²) Power loading 10.25 lbs./h.p. (4.66 kg./h.p.). Wing loading 16.3 lbs./ft.² (79.7 kg./m.²). Weight empty 2600 lbs. (1180 kg.). Useful load 1500 lbs. (682 kg.). Gross weight 4100 lbs. (1862 kg.). Baggage 100 lbs. (45.5 kg.). Fuel 112 gals. (424 lit.). Oil 7 gals. (26.5 lit.).
**Engine.** P & W Wasp Junior SB. 450 h.p. at 2300 r.p.m.; 300 h.p. at 2000 r.p.m. at 9600 ft. (2926 m.).
**Performance.** Cruising speed 205 m.p.h. (330 k.p.h.) at 10,000 ft. (3048 m.). Landing speed with flaps 54 m.p.h. (87 k.p.h.); without flaps 62 m.p.h. (100 k.p.h.) Service ceiling 22,000 ft. (6705 m.). Climb per min. 1460 ft. (445 m.). Cruising range 900 mi. (1448 km.).
**Construction.** Fuselage: heat treated 4130 chrome molybdenum steel tubing with 24S-T bulkheads bolted on; steel structure of 24S-T stiffeners and 24S-T Alclad skin. Wing: 4130 chrome molybdenum heat treated steel tube spars; 24S-T Alclad ribs; stiffeners of 24S-T with 24S-T Alclad skin; wing panel and tips removable. Flaps, all-metal with 24S-T Alclad skin. Tail group: all-metal, 24S-T Alclad covering. Fully retractable landing gear.
**Standard equipment.** Hamilton Standard controllable pitch propeller, General tires, Hayes wheels, Bendix hydraulic brakes, Cleveland Aerol shock absorbers, Reading battery, Fafnir engine and plane control bearings, Grimes navigation and landing lights, Pyrene fire extinguisher, International flares, first aid equipment, Plexiglas windshield and cabin enclosure, Eclipse starter, Solar cabin heater, gear retracting motor.
**Instruments.** Pioneer altimeter, air temperature, manifold pressure gauges, tachometer, airspeed, turn and bank, and rate of climb indicators, compass, carburetor temperature gauge; engine gauge unit; Weston thermocouple, ammeter; Sperry directional gyro; AC fuel gauge; wheel position lights.







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## STEARMAN-HAMMOND Model Y — 2-place — *ATC




Models Y-1 and Y-1S; data given in that order. *ATC 599; pending.

**Specifications.** Span 40′ (12.2 m.). Length 26′10.75″ (8.2 m.). Height 7′10.81″ (2.4 m.). Wing area 210 ft.² (19.5 m.²). Power loading 17.1 lbs./h.p. (7.7 kg./h.p.); 14.5 lbs./h.p. (6.6 kg./h.p.). Wing loading 10.2 lbs/ft.² (49.8 kg./m.²); 10.35 lbs./ft.² (50.5 kg./m.²). Weight empty 1400 lbs. (635 kg.); 1425 lbs. (646.4 kg.). Useful load 750 lbs. (340.2 kg.). Payload 310 lbs. (140.6 kg.). Gross weight 2150 lbs. (975.2 kg.); 2175 lbs. (986.6 kg.). Baggage 100 lbs. (45.4 kg.). Fuel 40 gals. (151.4 lit.). Oil 4 gals. (15.1 lit.).

**Engine.** Menasco, C-4, 125 h.p. at 2175 r.p.m.; Menasco C4S, 150 h.p. at 2260 r.p.m. at 3000 ft. (914.4 m.).

**Performance.** Maximum speed 120 m.p.h. (193.1 k.p.h.); 130 m.p.h. (209.2 k.p.h.). Cruising speed 110 m.p.h. (189.9 k.p.h.); 120 m.p.h. (193.1 k.p.h.). Landing speed with flaps 40 m.p.h. (64.4 k.p.h.); without flaps 50 m.p.h. (80.5 k.p.h.). Service ceiling 15,000 ft. (2414.1 m.); 18,500 ft. (5638.8 m.). Climb per min. 600 ft. (182.9 m.); 725 ft. (221 m.). Cruising range 540 mi. (869.1 km.); 500 mi. (804.7 km.).

**Construction.** Fuselage: all-metal, semi-monocoque, 24S-T bulkheads, formers, stringers and covering; side-by-side seating; baggage compartment aft of seats. Wing: full cantilever; all-metal, fabric covered; single box type spar; truss type ribs; 24S-T; Clark Y airfoil section. Flaps split trailing edge type. Tail group: full cantilever; all-metal, 24S-T. Three-wheel fixed landing gear; front wheel steerable.

**Standard equipment.** General tires, Hayes wheels and hydraulic brakes, Warner oil and spring shock absorbers, Exide battery, Fafnir and Torrington bearings for engine and plane controls, Grimes navigation lights, electric starter, generator.

**Instruments.** Altimeter, oil pressure and oil temperature gauges, tachometer, ammeter, airspeed indicator, compass, electric fuel gauge, fuel pressure warning light.



## STINSON A Airliner — 8 passengers—2 pilots — ATC 556




**Specifications.** Span 60′ (18.3 m.). Length 37′(11.3 m.). Height 12′ (3.9 m.). Wing area 500 ft.² (46.5 m.²). Power loading 13.1 lbs./h.p. (5.9 kg./h.p.). Wing loading 20.4 lbs./ft.² (99.6 kg./m.²). Weight empty 7200 lbs. (3265.9 kg.). Useful load 3000 lbs. (1360.8 kg.). Payload 1860 lbs. (843.7 kg.). Gross weight 10,200 lbs. (4626.7 kg.). Baggage 500 lbs. (226.8 kg.). Fuel 160 gals. (605.7 lit.). Oil 12 gals. (45.4 lit.).

**Engine.** Lycoming R-680-5 (three), 260 h.p. at 2300 r.p.m.

**Performance.** Maximum speed 180 m.p.h. (289.7 k.p.h.). Cruising speed 170 m.p.h. (273.4 k.p.h.) at 1950 r.p.m. at 7000 ft. (2133.6 m.). Landing speed with flaps 65 m.p.h. (104.6 k.p.h.). Service ceiling 17,000 ft. (5181.6 m.). Climb per min. 1000 ft. (304.8 m.). Cruising range 640 mi. (1030 km.).

**Construction.** Fuselage: welded chrome molybdenum steel tubing; fabric covered; nose portion metal clad forward of front of cabin. Wing: heat treated welded chrome molybdenum steel tube spars; dural tubular ribs riveted; fabric covered; all-metal stub wings. All-metal flaps electrically operated. Tail group: steel tube frame; fabric covered; rudder and elevator tabs adjustable in flight. Fully retractable landing gear, electrically operated; wheels retract into wells located in underside of engine nacelles.

**Standard equipment.** Hamilton Standard controllable pitch propellers, Eclipse starter, Goodyear Airwheels and brakes, Cleveland Pneumatic shock absorbers, Exide battery, Grimes navigation lights, Pyle-National landing lights, Kidde fire extinguisher, Wiley flares, shatterproof windshield and cabin glass, Seapak insulation.

**Instruments.** Kollsman altimeter, manifold pressure gauge; Pioneer clock, fuel and oil pressure gauges, airspeed, rate of climb, turn and bank indicators, compass; Weston thermocouple, oil temperature and carburetor temperature gauge, ammeter, Sperry directional gyro, gyro-horizon; AC flap position indicator, fuel gauge.

*Other data in March, 1934,* AERO DIGEST.



## STINSON Reliant — 4-5-place — ATC 621-625




Models SR-9B, SR-9BD, SR-9CD, SR-9DD, SR-9ED; data given in that order.

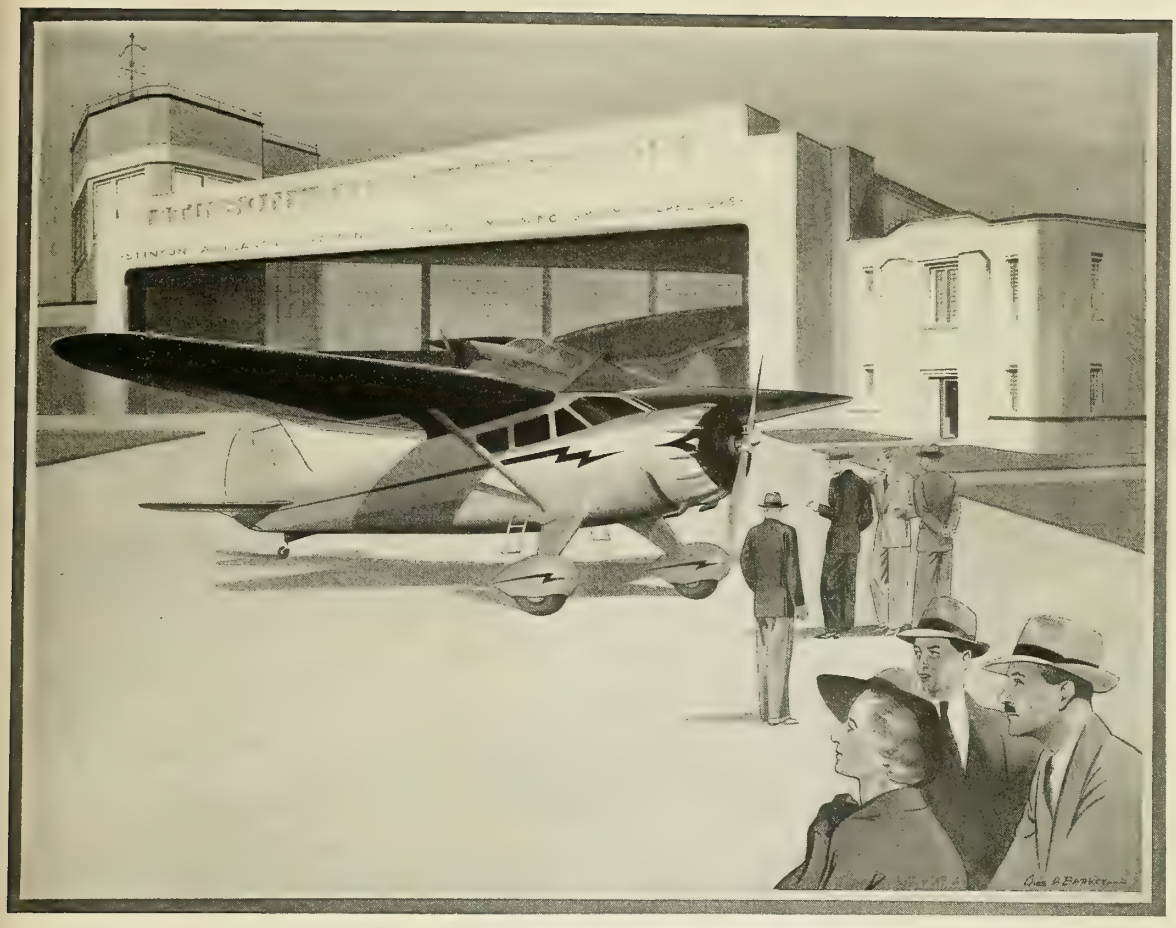
**Specifications.** Span 41′ 10.5″ (12.7 m.). Length 27′ 11″ (8.5 m.). Height 8′ 6″ (2.6 m.). Wing area 258.5 ft.² (24 m.²). Power loading (lbs./h.p.) 15; 15; 14.4; 13.7; 12.6: (kg./h.p.) 6.8; 6.8; 6.5; 6.3; 5.7. Wing loading (lbs./ft.²) 14.3; 14.3; 14.5; 15.3; 15.7; (kg./m.²) 69.7; 69.7; 70.8; 74.6; 76.7. Weight empty (lbs.) 2457; 2480; 2515; 2640; 2640: (kg.) 1114; 1125; 1141; 1197; 1197. Useful load (lbs.) 1243; 1220; 1235; 1310; 1410; (kg. 564; 553; 560; 594; 640. Payload (lbs.) 813; 592; 607; 622; 722: (kg.) 369; 269; 275; 282; 327. Gross weight (lbs.) 3700; 3700; 3750; 3950; 4050: (kg.) 1678; 1678; 1701; 1792; 1837. Baggage (lbs.) 105: 82; 97; 112; 212 (inc. spec. eqpt.): (kg.) 48; 37; 44; 51; 96.2.

**Engine.** Lycoming R-680-B6, 245 h.p. at 2300 r.p.m.; Lycoming R-680-B6, 245 h.p. at 2300 r.p.m.; Lycoming R-680-5, 260 h.p. at 2300 r.p.m.; Wright Whirlwind R-760E-1, 285 h.p. at 2100 r.p.m.; Wright Whirlwind R-760E-2, 320 h.p. at 2100 r.p.m.

**Performance.** Cruising speed (m.p.h.) 143; 143; 145; 156; 161: (k.p.h.) 230; 230; 233; 251; 259.1. Landing speed (m.p.h.) 52; 52; 53; 54; 55: (k.p.h.) 83.7; 83.7; 85.3; 86.9; 88.5. Service ceiling (ft.) 13,200; 13,200; 14,500; 15,500; 17,500: (m.) 4023; 4023; 4420; 4720; 5334. Climb per min. (ft.) 800; 800; 825; 875; 1050: (m.) 244; 244; 251; 267; 320. Cruising range (mi.) 615; 615; 630; 625; 700; (km.) 990; 990; 1014; 1006; 1126.5.

**Construction.** Fuselage: welded chrome moly steel tubing; aluminum alloy covered forward; fabric covered aft. Wing: Stinson sesqui-spar chrome moly welded steel heat-treated main beam, dural auxiliary beam; dural ribs; fabric covered. Tail group: welded chrome-moly steel, fabric covered.

**Standard equipment.** Hamilton Standard controllable pitch propeller, hydraulic brakes, battery, Grimes navigation lights, Pyrene fire extinguisher, Seapak insulation, starter, generator, ventilating and heating system.



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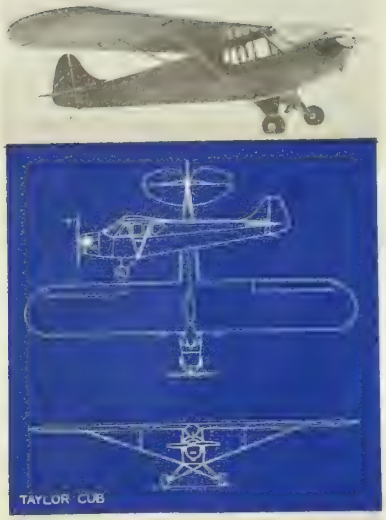
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## TAYLOR Cub Model J2

2-place

**ATC 595**

**Specifications.** Span 35′ 2.5″ (10.74 m.). Length 22′ 6″ (6.87 m.) Height 6′ 8″ (2.03 m.). Wing area 178.5 ft.² (16.6 m.²). Power loading 24.2 lbs./h.p. (10.95 kg./h.p.). Wing loading 5.42 lbs./ft.² (26.6 kg./m.²). Weight empty 563 lbs. (255 kg.). Useful load 407 lbs. (184 kg.). Payload 175 lbs. (79.4 kg.). Gross weight 970 lbs. (440 kg.). Baggage 5 lbs. (2.3 kg.) Fuel 9 gals. (34.1 lit.). Oil 1 gal. (3.8 lit.).

**Engine.** Continental A-40-4, 40 h.p. at 2575 r.p.m.

**Performance.** Maximum speed 85 m.p.h. (137 k.p.h.). Cruising speed 72 m.p.h. (116 k.p.h.). Landing speed 30 m.p.h. (48.3 k.p.h.). Service ceiling 12,000 ft. (3657.6 m.). Climb per min. 450 ft. (137.2 m.). Cruising range 210 mi. (338 km.).

**Construction.** Fuselage: Warren truss frame of chrome molybdenum and carbon steel tubing; detachable engine mount; steel fairing strips; tandem seating arrangement; dual controls; quick opening section in fuselage to right of seats to permit easy entrance and exit; fabric covered. Wing: U.S.A. 35B airfoil section; solid spruce spars; steel tube compression struts; steel tie rods; riveted aluminum alloy ribs; Vee type external bracing consisting of two streamline tubes meeting at lower longerons; fabric covered. Tail group: welded steel tube and channel sections; wire bracing of chrome vanadium tie rods between rear spars of surfaces and lower longeron; stabilizer adjustable in flight; fabric covered. Fixed split type landing gear with shock cord rings. Leaf spring tail skid. Licensed by Dept. of Commerce as a seaplane on Edo model D-1070 floats.

**Standard equipment.** Sensenich type 69-D wood propeller, Goodrich 8.00 × 4 tires, Hayes wheels, shock cord ring absorbers, Grinnel fire extinguisher, Johnson & Johnson first aid equipment, fabrikoid upholstery, Pyralin windshield and cabin enclosure.

**Instruments.** Aeromarine altimeter; U.S. Gauge oil pressure gauge and oil temperature gauge; Waltham tachometer; Taylor fuel gauge.




## TAYLORCRAFT Model A

2-place

**ATC 529**

**Specifications.** Span 36′ (11 m.) Length 22′ (6.7 m.). Height 6′ 8″ (2.1 m.). Wing area 155 ft.² (14.4 m.²). Power loading 26 lbs./h.p. (11.8 kg./h.p.) Wing loading 5.8 lbs./ft.² (29.3 kg./m.²). Weight empty 586 lbs. (265.8 kg.). Useful load 464 lbs. (210.5 kg.). Payload 226 lbs. (102.5 kg.). Gross weight 1050 lbs. (476.3 kg.). Baggage allowance 56 lbs. (25.4 kg.). Fuel 10 gals. (37.8 lit.). Oil 1 gal. (3.8 lit.).

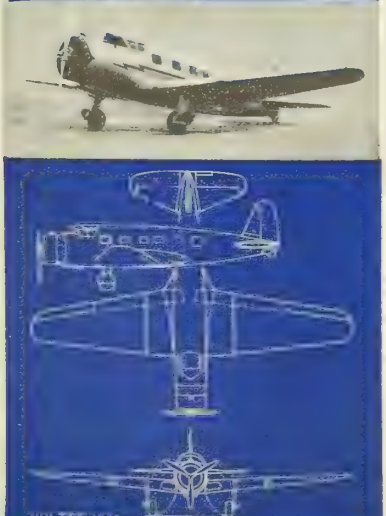
**Engine.** Continental A-40-4 h.p. at 2575 r.p.m.

**Performance.** Maximum speed 91 m.p.h. (146.5 k.p.h.). Cruising speed 80 m.p.h. (129 k.p.h.). Landing speed 35 m.p.h. (46.3 k.p.h.). Service ceiling 14,000 ft. (4260 m.). Climb per min. 390 ft. (118.9 m.). Cruising range 230 mi. (371 km.).

**Construction.** Fuselage: welded steel tubing, truss type; fabric covered; side-by-side seating arrangement with dual wheel controls of the inset panel type. A large door is provided on the starboard side, hinged to swing forward. Wing: metal ribs; wood spars; fabric covered; bracing by a pair of steel tube streamlined V struts attaching to the bottom fuselage longeron aft of cabin door, and having vertical intermediate struts loccated at their centers. Tail group: welded steel tubing; fabric covered; braced by wires extending from the trailing edge of the stabilizer to the trailing edge of the fin, and to bottom fuselage longeron. Fixed divided type landing gear with shock cord absorption at the center. Welded steel tail skid swivelling through 120°.

**Standard equipment.** Sensenich metal-tipped wood propeller 69 inches in diameter, Silvertown 6.00 × 6 tires, plain oilless bearings in control system, wired for navigation lights and indirect lighting of the instrument panel, fire extinguisher, imitation leather upholstery, Plastecele windshield and cabin enclosure, removable dual wheel controls, Shinn Devices, Timken-bearing wheels.

**Instruments.** Aeromarine altimeter and airspeed indicator; Taylorcraft combination oil pressure, oil temperature gauge, tachometer.




## VULTEE V-1A

8-10 place

**ATC 545**

**Specifications.** Span 50′ (15.2 m.). Length 37′ 2″ (11.33 m.). Height 10′ 2″ (3.1 m.). Wing area 384 ft.² (35.7 m.²). Power loading 10 lbs./h.p. (4.54 kg./h.p.). Wing loading 22.1 lbs./ft.² (107.9 kg./m.²). Weight empty 5952 lbs. (2700 kg.). Useful load 2548 lbs. (1156 kg.). Payload 1470 lbs. (666 kg.). Gross weight 8500 lbs. (3856 kg.). Baggage 450 lbs. (204 kg.). Fuel 149 gals. (566 lit.). Oil 19 gals. (72 lits.).

**Engine.** Wright Cyclone R1820G-5, 850 h.p. at 2100 r.p.m. at 5800 ft. (1770 m.).

**Performance.** Maximum speed 240 m.p.h. (386 k.p.h.) at 12,000 ft.; 226 m.p.h. (363 k.p.h.) at 5800 ft. Cruising speed 217 m.p.h. (349 k.p.h.). Landing speed with flaps 63 m.p.h. (101 k.p.h.). Service ceiling 29,000 ft. (8850 m.). Climb per min. 1400 ft. (427 m.). Cruising range 950 mi. (1528 m.).

**Construction.** Fuselage: all-metal, 24S-T; monocoque; welded tubular detachable engine mount. Wing: all-metal, 24S-T; stressed skin; full cantilever in three sections. Split trailing edge type flaps, all-metal manually or electrically operated. Tail group: all-metal, 24S-T; stressed skin; full cantilever; rudder and elevators metal box spar and rib construction, latter fabric covered; elevators dynamically balanced.

**Standard equipment.** Hamilton Standard controllable pitch propeller, Eclipse starter, Goodyear tires, wheels and disc brakes, oleo shock absorbers, Exide battery, Fafnir ball bearings for engine and plane controls, Grimes navigation lights, S & M landing lights, Kidde Lux fire extinguisher, Wiley flares, Seapak insulation, lavatory equipment.

**Instruments.** Kollsman altimeter and sensitive altimeter, tachometer, airspeed and rate of climb indicators, compass, manifold pressure gauge, engine gauge unit; Pioneer turn and bank indicator; Weston air temperature gauge, thermocouple, ammeter, carburetor temperature gauge; Waltham clock; MotoMeter fuel gauge; Sperry directional gyro, gyro-horizon

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## WACO C-7

5-place

*ATC

*ATC pending.
Information given covers Model YGC-7. The custom cabin series is also manufactured as ZGC-7 with Jacobs L-5, 285 h.p.; UGC-7 with Continental W670-K, 225 h.p.; VGC-7 with Continental W670-M-1, 250 h.p.; DGC-7 with Wright Whirlwind R760E-1, 285 h.p.; EGC-7 with Wright Whirlwind R760E-2, 320 h.p. Weights and performances vary according to engines.

**Specifications.** Span 35′ (10.7 m.). Length 26′ 7″ (8.1 m.). Height 8′ 8″ (2.6 m.). Wing area 246 ft.² (22.8 m.²). Power loading 16.23 lbs./h.p. (7.3 kg./h.p.). Wing loading 14.83 lbs./ft.² (72.4 kg./m.²). Weight empty 2130 lbs. (966.2 kg.). Useful load 1520 lbs. (689.5 kg.). Payload 892 lbs. (404.6 kg.). Gross weight 3650 lbs. (1655.7 kg.). Baggage 100 lbs. (45.4 kg.). Fuel 70 gals. (265 lit.). Oil 5 gals. (18.9 lit.).

**Engine.** Jacobs L-4, 225 h.p. at 2000 r.p.m.

**Performance.** Maximum speed 158 m.p.h. (254.3 k.p.h.). Cruising speed at sea level at 75% power 140 m.p.h. (225.3 k.p.h.); at 6000 ft. (1828.8 m.) at 2000 r.p.m. 149 m.p.h. (239.8 k.p.h.). Landing speed 52 m.p.h. (83.7 k.p.h.). Service ceiling 15,500 ft. (4724.4 m.). Climb per min. 700 ft. (213.4 m.). Cruising range 625 mi. (1005.9 km.).

**Construction.** Fuselage: welded steel tubing; wood fairing members; fabric covered. Wings: wood spars; wood ribs; metal compression members; fabric covered. Tail group: fin and stabilizer, wood spars and ribs, plywood and fabric covered; elevators and rudder, steel tube spars, metal ribs; fabric covered. Fixed type landing gear.

**Standard equipment.** Curtiss Reed propeller, Hayes wheels and hydraulic brakes, navigation lights, Grimes landing lights, first aid equipment, fire extinguisher, NACA cowl, wheel cuffs, electric starter (generator with battery ignition only).

**Instruments.** Tachometer, altimeter, compass, airspeed indicator, oil pressure and oil temperature gauges, volt-ammeter, fuel gauges (manifold pressure gauge on Models DGC, EGC and ZGC).





## WACO S-7

5-place

ATCs 528-533

Information given covers Model YKS-7. The standard cabin series is also manufactured as ZKS-7 with Jacobs L-5, 285 h.p.; UKS-7 with Continental W670-K, 225 h.p.; and the VKS-7 with Continental W670-M1, 250 h.p. Weights and performances vary according to engines.

**Specifications.** 33′ 3″ (10.1 m.). Length 25′ 4″ (7.7 m.). Height 8′ 7″ (2.6 m.). Wing area 240 ft.² (22.3 m.²). Power loading 14.45 lbs./h.p. (6.5 kg./h.p.). Wing loading 13.54 lbs./ft.² (66.1 kg./m.²). Weight empty 1866 lbs. (846.4 kg.). Useful load 1384 lbs. (627.8 kg.). Payload 756 lbs. (342.9 kg.). Gross weight 3250 lbs. (1474.2 kg.). Baggage 100 lbs. (45.4 kg.). Fuel 70 gals. (265 lit.). Oil 5 gals. (18.9 lit.).

**Engine.** Jacobs L4, 225 h.p. at 2000 r.p.m.

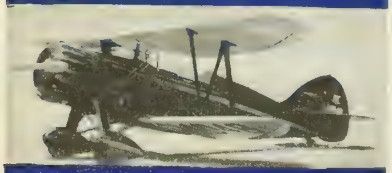
**Performance.** Maximum speed 147 m.p.h. (236.6 k.p.h.). Cruising speed at sea level at 75% power 130 m.p.h. (209.2 k.p.h.); at 6000 ft. (1828.8 m.) at 2000 r.p.m. 140 m.p.h. (225.3 k.p.h.). Landing speed 49 m.p.h. (78.9 k.p.h.). Service ceiling 15,000 ft (4572 m.). Climb per min. 800 ft. (243.8 m.). Cruising range 585 mi. (941.7 km.).

**Construction.** Fuselage: welded steel tubing; wood fairing members; fabric covered; dual control provision by throw-over control wheel; adjustable front seats; baggage compartment. Wings: Clark Y airfoil section; spars, wood; ribs, wood; metal compression members; fabric covered; ailerons on all wings; top wings hinged to top fuselage ailerons. Tail group: welded steel tubing; fabric covered; trimming tab on rudder. Fixed individual leg type landing gear.

**Standard equipment.** Wood propeller, electric starter (generator with battery ignition only), navigation lights, wheel cuffs, mechanical toe-operated brakes with hand parking lever, Hayes wheels and brakes, first aid equipment, fire extinguisher, NACA cowl, throw-over wheel control.

**Instruments.** Tachometer, altimeter, compass, airspeed indicator, oil pressure and oil temperature gauges, voltmeter-ammeter, fuel gauges.





## WACO S3HD

2-place

ATC 543

**Specifications.** Span 32′ 8.67″ (10 m.). Length 25′ .5″ (7.6 m.). Height 8′ 11.5″ (2.7 m.). Wing area 256.3 ft.² (23.8 m.²). Power loading 10 lbs./h.p. (4.5 kg./h.p.). Wing loading 15.43 lbs./ft.² (74.3 kg./m.²). Weight empty 2487 lbs. (1128.1 kg.). Useful load 1126 lbs. (510.7 kg.). Payload 362 lbs. (164.2 kg.). Gross weight 4200 lbs. (1905.1 kg.). Fuel 90 gals. (340.7 lit.). Oil 6 gals. (22.7 lit.).

**Engine.** Pratt & Whitney Wasp Junior, 420 horsepower.

**Performance.** Maximum speed 196 m.p.h. (315.5 k.p.h.). Cruising speed 170 m.p.h. (273.6 k.p.h.). Landing speed 60 m.p.h. (96.6 k.p.h.). Service ceiling 20,000 ft. (6096 m.). Climb per min. 1600 ft. (487.7 m.). Cruising range 600 mi. (965.6 km.).

**Construction.** Fuselage: chrome molybdenum welded steel tubing; fabric covered; tandem seating arrangement with dual controls; coupé top for each cockpit; baggage compartment aft of rear seat. Wings: spruce spars; spruce and plywood ribs; fabric covered; external bracing by streamlined wires; *N*-type interplane struts. Inset ailerons provided on the upper panels. Tail group: wood spars; metal ribs in fin and stabilizer; metal tubing in rudder and elevators; fabric covered; stabilizer adjustable. Fully swivelling tail wheel. Fixed divided type landing gear. Also licensed as seaplane by Dept. of Commerce on Edo model 4000 floats.

**Standard equipment.** Hamilton Standard adjustable pitch propeller, Eclipse starter, Hayes wheels and hydraulic brakes, oleo shock absorbers, Reading battery, Grimes navigation lights, Grimes landing lights, International flares, bonding and shielding, generator, indirectly lighted instrument panel, metal wheel pants.

**Instruments.** Pioneer or Kollsman altimeter, manifold pressure gauge, tachometer, fuel pressure gauge, compass, oil pressure and oil temperature gauges, turn and bank and rate of climb indicators; thermocouple, voltmeter-ammeter.

*Other data in June, 1935,* AERO DIGEST.



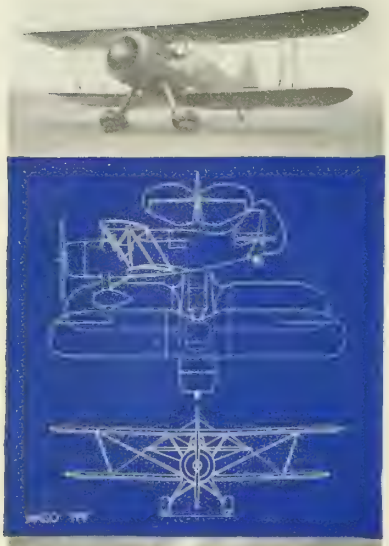

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## WACO YPF

3-place

**ATC 586**

**Specifications.** Span 30′ (9.2 m.). Length 22′ 10″ (7 m.). Height 8′ 5.5″ (2.6 m.). Wing area 243 ft.² (22.7 m.²). Power loading 11.76 lbs./h.p. (5.3 kg./h.p.) Wing loading 10.90 lbs./ft.² (53.1 kg./m.²) Weight empty 1675 lbs. (758 kg.). Useful load 975 lbs. (442 kg.). Payload 484 lbs. (220 kg.). Gross weight 2650 lbs. (1200 kg.). Baggage 75 lbs. (34 kg.). Fuel 50 gals. (189.3 lit.). Oil 4 gals. (15.1 lit.).
**Engine.** Jacobs L-4, 225 h.p. at 2000 r.p.m. This airplane also manufactured as UPF with Continental 225 h.p.; as ZPF with Jacobs 285 h.p.; CPF with Wright Whirlwind 250 h.p.; DPF with Wright Whirlwind 285 h.p.; EPF with Wright Whirlwind 320 h.p. (Varying payloads, performances.)
**Performance.** Maximum speed 150 m.p.h. (242 k.p.h.). Cruising speed 132 m.p.h. (213 k.p.h.) at 1900 r.p.m. Landing speed 48 m.p.h. (77.3 k.p.h.). Service ceiling 18,000 ft. (5490 m.). Climb per min. 1150 ft. (350 m.). Cruising range 450 mi. (725 km.).
**Construction.** Fuselage: chrome molybdenum steel tubing, welded; fabric covered; tandem seating arrangement, with two seats side-by side in front; dual controls; baggage compartment. Rear cockpit provided with sliding enclosure, front cockpit open. Wings: spruce spars; spruce and plywood ribs; fabric covered; center section carried above fuselage on *N*-struts with *N*-strut interplane bracing; ailerons on all wings. Tail group: wood spars; dural ribs; fabric covered; adjustable stabilizer. Fully swivelling tail wheel.
**Standard equipment.** Curtiss Reed propeller, Eclipse starter, Goodrich or Firestone tires, Goodyear tail wheel tire, Hayes wheels and hydraulic brakes, Reading battery, Grimes navigation and landing lights, Fyr Fyter fire extinguisher, Pyralin cabin enclosure, non-shatterable safety glass for windshield, Bauer & Black first aid kit.
**Instruments.** Pioneer or Kollsman altimeter, tachometer, compass, airspeed indicator; Pioneer manifold pressure gauge, oil pressure and oil temperature gauges; Weston ammeter; AC fuel gauge.

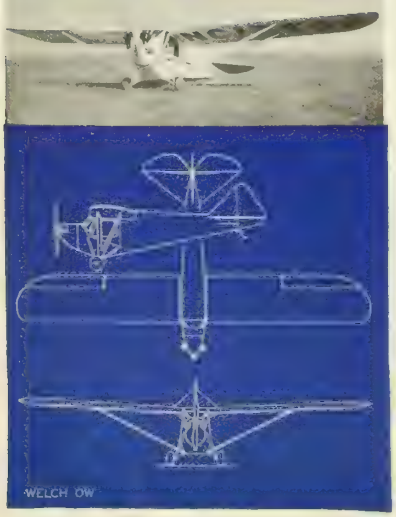



## WATERMAN Arrowbile W-5

2-place

***ATC**

*ATC pending.
**Specifications.** Span 38′ (11.6 m.). Length 9′ 4″ (3 m.). Height 8′ 8″ (2.6 m.). Wing area 264 ft.² (24.4 m.²). Power loading 22 lbs./h.p. (8 kg./h.p.). Wing loading 8.34 lbs./ft.² (40.7 kg./m.²). Weight empty 1630 lbs. (739.4 kg.). Useful load 570 lbs. (258.5 kg.). Payload 400 lbs. (181.4 kg.). Gross weight 2200 lbs. (997.9 kg.). Baggage 60 lbs. (27.2 kg.). Fuel 25 gals. (94.6 lit.). Oil 2 gals. (7.6 lit.).
**Engine.** Studebaker-Waterman S-1, 100 h.p. at 1750 r.p.m.
**Performance.** Maximum speed 120 m.p.h. (193.1 km./hr.). Cruising speed 105 m.p.h. (169 km./hr.) at 75 h.p. (1625 r.p.m.). Landing speed 45 m.p.h. (72.4 km./hr.). Service ceiling 15,000 ft. (4572 m.). Climb per min. 700 ft. (213.4 m.). Cruising range 400 mi. (643.8 km.).
**Construction.** Fuselage: all-metal construction; steel tubing; dual covered. Wing: dural ribs; wood spars; steel tube drag struts; tie rods; leading edge and center section dural covered; balance fabric covered; entire wing quickly detachable. Flap action by deflection of both rudders. Fixed type landing gear. Swivelling (20°) nose wheel. This airplane has been so designed that it can be converted into a roadable vehicle.
**Standard equipment.** Story 8′ wood propeller, Firestone 4.50 × 12 × 21 landing gear tires, Firestone nose wheel, Bendix mechanical brakes, oil- and spring shock absorbers, Willard battery, Timken and Norma-Hoffmann ball and roller bearings for engine and plane controls, Grimes navigation lights, Waterman landing lights, Pyrene fire extinguisher, Pyralin windshield, Auto-Lite starter and generator, Arens type throttle controls, first aid equipment, broadcloth upholstery.
**Instruments.** Pioneer altimeter, airspeed indicator and compass; Stewart-Warner fuel gauges, oil pressure and oil temperature gauges, tachometer, ammeter; speedometer, water temperature gauge; Air Associates bank indicator.

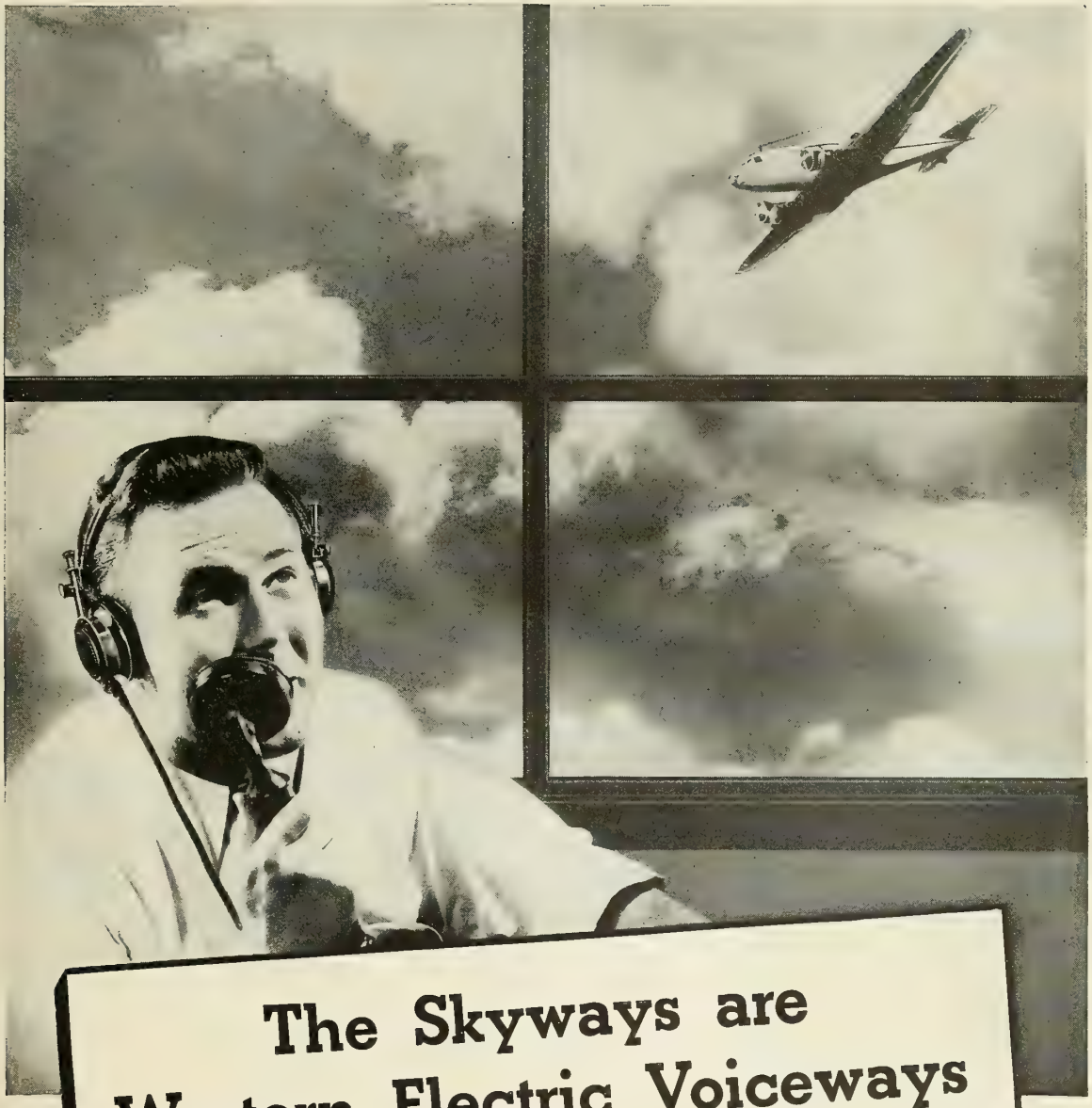



## WELCH OW

2-place

**Approval 2-474**

**Specifications.** Span 34 feet 4 inches (10.5 meters). Length 21 feet (6.4 meters). Height 5 feet 8 inches (1.7 meters). Wing area 136 square feet (12.6 square meters). Power loading 26 pounds per horsepower (11.8 kilograms per horsepower). Wing loading 6.6 pounds per square foot (32.2 kilograms per square meter). Weight empty 540 pounds (244.9 kilograms). Useful load 394 pounds (178.7 kilograms). Payload 170 pounds (77.1 kilograms). Gross weight 950 pounds (430.9 kilograms). Fuel 10 gallons (37.8 liters). Oil 1 gallon (3.8 liters).
**Engine.** Welch Model O-2, 45 horsepower at 2500 revolutions per minute.
**Performance.** Maximum speed 93 miles per hour (149.7 kilograms per hour). Cruising speed 85 miles per hour (136.8 kilograms per hour). Landing speed 29 miles per hour (46.7 kilograms per hour). Service ceiling 11,000 feet (3352.8 meters). Climb per min. 450 feet (137.2 meters). Cruising range 200 miles (321.9 kilometers).
**Construction.** Fuselage: steel tubing, with fabric covering; forward portion metal cowled; three longerons, one longeron on bottom extending back from cabin; seating arrangement is side-by-side with overhead wheel type controls; manufactured in either open or closed models. Wing: fabric covered; spars are built up from two-ply spruce web with spruce cap strips; ribs are of basswood; dural drag struts are used with drag wires; conventional ailerons; large diameter streamline chrome molybdenum steel tube V type wing bracing struts converging at fittings on the fuselage which are also used to secure the top axle fitting. Tail group: chrome molybdenum steel tubing; wire bracing, adjustable by placing a bolt in one of a series of holes in a plate fitting at the front of the stabilizer. Fixed type landing gear.
**Standard equipment.** Flottorp propeller, ignition switch, 16 × 7.3 airwheels, controls operated by cable on plain bearings, mechanically operated starter.
**Instruments.** Fuel pressure gauge, oil pressure gauge, tachometer and oil temperature gauge.



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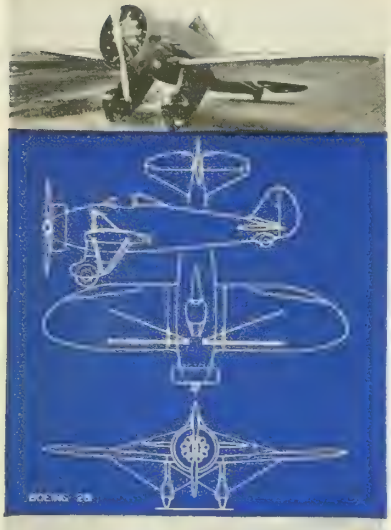
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# Military Airplanes

**Most of the airplanes described in this section are proven types, having been in use by the U.S. Army and Naval Air Service. Some have found favor in the air forces of foreign countries. The types shown in the following 32 miniature blueprints (and their optional variations mentioned in some cases), are available for export. War and Navy Department regulations prohibit publication of detailed data on the most recent U.S. military types, blueprints of eight of which are shown on page 124.**




## BOEING 281 — 1-place — FIGHTER-BOMBER

Fighter with normal fuel load, fighter with maximum fuel load and bomber with normal fuel load; data given in that order.

**Specifications.** Span 27′ 11.67″ (8.5 m.). Length 23′ 7.25″ (7.2 m.). Height 7′ 10.44″ (2.4 m.). Wing area 149.5 ft.² (13.9 m.²) Power loading (lbs./h.p.) 6.1; 6.8; 6.6: (kg./h.p.) 2.6; 3; 2.9. Wing loading (lbs./ft.²) 20.3; 22.6; 22.1: (kg./m.²) 99; 110.2; 107.8. Weight empty 2353.6 lbs. (1067.5 kg.). Useful load (lbs.) 685; 1026.6; 950.4: (kg.) 310.8; 465.7; 431.2. Gross weight (lbs.) 3038.6; 3380.2; 3304: (kg.) 1378.3; 1533.2; 1498.7. Fuel (gals.) 55; 107; 55: (lit.) 208.2; 405; 208.2. Oil (gals.) 4; 7.95; 4: (lit.) 15.1; 30.1; 15.1.

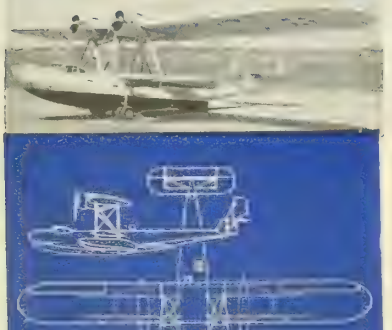
**Engine.** P & W Wasp SE, 500 h.p. at 2200 r.p.m. at 11,000 ft. (3352.8 m.).

**Performance.** Maximum speed (m.p.h.) at 11,000 ft. (3352.8 m.) 232.5; 230.5; 219: (k.p.h.) 374; 370.8; 352.3; at 6000 ft. (1829 m.) 235; 233; 221: (k.p.h.) 378.1; 374.8; 355.5 at sea level (m.p.h.) 215; 213; 203: (k.p.h.) 345.9; 342.7; 326.6. Cruising speed at 11,000 ft. (3352.8 m.) and 6000 ft. (1829 m.) in m.p.h., 210; 208; 197: (k.p.h.) 337.8; 334.6; 316.9. Landing speed (m.p.h.) 68.1; 72; 71.1: (k.p.h.) 109.5; 115.8; 114.3. Service ceiling (ft.) 28,200; 24,900; 25,200: (m.) 8595.3; 7589.2; 7680.9. Climb per min. (ft.) at sea level 2210; 1920; 1940: (m.) 673.6; 585.2; 591.3. Cruising range at 11,000 ft. (3352.8 m.) in mi., 386; 745; 360; (km.) 621; 1198.7; 579.2.

**Construction.** Fuselage: all-metal, semi-monocoque consisting of bulkheads, stiffeners and smooth covering; aluminum alloy except highly stressed fittings which are steel. Wing: spars built up I-beam sections; Warren truss type ribs; smooth aluminum alloy sheet covered. Split trailing edge flap. Tail group: all-metal; cantilever.

**Standard equipment.** Hamilton Standard propeller, Eclipse starter, Goodyear tires, Firestone tail wheel tire, brakes, oleo shock absorbers, battery, navigation lights.

**Instruments.** Complete flight and engine installation.




## CONSOLIDATED P2Y-3 — PATROL

**Specifications.** Span 100′ (30.5 m.). Length 61′ 9″ (18.8 m.). Height 17′ 3″ (5.3 m.). Wing area 1514 ft.² (143 m.²). Power loading 14.75 lbs./h.p. (6.7 kg./h.p.). Wing loading 13.65 lbs./ft.² (66.6 kg./m.²). Weight empty 11,700 lbs. (5300 kg.). Useful load 8400 lbs. (3810 kg.). Gross weight 20,000 lbs. (9070 kg.). Maximum gross weight 24,000 lbs. (10,880 kg.). Fuel 1620 gals. (6120 lit.). Oil 90 gals. (341 lit.).

**Engine.** Wright Cyclone R-1820-90 (two), 700 h.p. at 1950 r.p.m. at 4000 ft. (1219.2 m.).

**Performance.** Maximum speed 140 m.p.h. (225 k.p.h.). Cruising speed 117.5 m.p.h. (189 k.p.h.). Landing speed 61 m.p.h. (98 k.p.h.). Service ceiling 16,500 ft. (5040 m.). Climb per min. 700 ft. (213 m.). Cruising range 2650 mi. (4270 km.).

**Construction.** Sesquiplane Flying Boat. Hull: series of 4 watertight bulkheads with intermediate beltframes, keel and aluminum alloy sheet skin with Z-shaped extruded aluminum alloy stringers. Wings: metal spars and ribs, fabric covered; engines mounted in leading edge. Tail group: all-metal construction, except fins which are fabric covered.

**Standard equipment.** Curtiss 3-bladed electrically-controllable pitch propellers, storage battery, ball bearing engine and plane controls, navigation lights, General Electric leading edge landing lights, Eclipse starter, fire extinguisher, flares, laminated windshield and cabin glass, lavatory equipment, 4-man life raft, radio receiver and transmitter.

**Instruments.** Altimeter type AN5718, sensitive altimeter type AN5728, manifold pressure gauges, clock type AN5726; hydrostatic fuel gauges, fuel pressure gauge type AN5516, oil temperature gauges type AN5521, electric tachometers type NAF39-914, directional gyro, gyro-horizon, airspeed indicator type AN5705-2, turn and bank indicators, type X-St'd. 39905, compass, lateral inclinometer type AN5725. (AERO DIGEST, *Oct., 1935, pg. 78.*)

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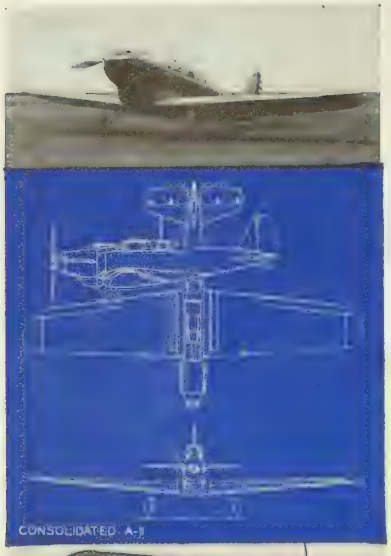
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## CONSOLIDATED A-11

2-place **ATTACK**

**Specifications.** Span 43′ 10.75″ (13.4 m.). Length 29′ 3.5″ (8.9 m.). Height 8′ 4″ (2.5 m.). Wing area 297 ft.². (27.6 m.²). Power loading 8.07 lbs./h.p. (3.7 kg./h.p.). Wing loading 18.2 lbs./ft.² (88.9 kg./m.²). Weight empty 3750 lbs. (1700 kg.). Useful load 1685 lbs. (762 kg.). Gross weight 5435 lbs. (2460 kg.). Maximum gross weight 6350 lbs. (2880 kg.). Fuel (normal) 90 gals. (341 lit.); maximum 180 gals. (682 lit.). Oil (normal) 6 gals. (22.7 lit.); auxiliary 3.6 gals. (13.6 lit.).

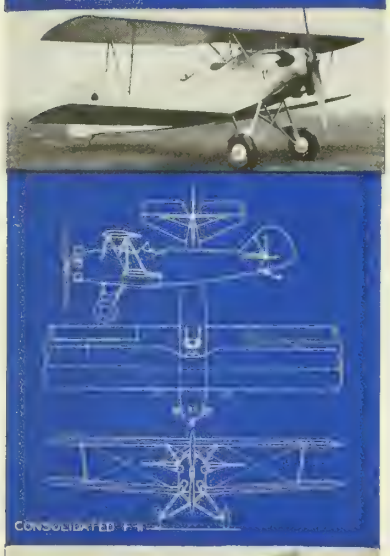
**Engine.** Curtiss Conqueror V1570, 675 h.p. at 2450 r.p.m.

**Performance.** Maximum speed 227 m.p.h. (365 k.p.h.). Cruising speed 193 m.p.h. (311 k.p.h.) at 2150 r.p.m. Landing speed with flaps 67.5 m.p.h. (109 k.p.h.); without flaps 73 m.p.h. (117 k.p.h.). Service ceiling 23,300 ft. (7100 m.). Climb per min. at sea level 1630 ft. (498 m.). Cruising range 1260 mi. (2030 km.).

**Construction.** Fuselage: monocoque; aluminum alloy having a series of elliptical channel frames of 24S-T aluminum alloy and skin of 24S-T aluminum alloy sheet; demountable engine mount of welded chrome molybdenum steel tubing. Wing: all-metal; one-piece; full cantilever, stressed skin; Clark Y airfoil section. Trailing edge flaps manually operated. Tail group: fin and stabilizer all-metal, full cantilever, stressed skin; elevators and rudder 24S-T aluminum alloy, fabric covered; fixed stabilizer. Fully retractable landing gear, manually operated. Fully swivelling tail wheel.

**Standard equipment.** Streamline tires, hand and electric starter, Bendix wheels and brakes, Cleveland Pneumatic oleo shock absorbers, battery, Fafnir bearings for engine and plane controls, navigation lights, flares, laminated glass windshield, interphones, radio receiver and transmitter, life preserver cushions.

**Instruments.** Sensitive altimeter type C-5, clock type A-6, Liquidmeter fuel gauge, tachometer type C-2, airspeed indicator type C-4, turn and bank indicator type A-2, compass type D-7, Prestone thermometer type A-6, engine gauge unit type B-1.




## CONSOLIDATED F-11

2-place **TRAINER**

**Specifications.** Span 28′ (9.2 m.). Length 21′ 8″ (7.1 m.). Height 7′ 9″ (2.5 m.). Wing area 194.4 ft.² (18 m.²). Power loading 11.1 lbs./h.p. (5.4 kg./h.p.). Wing loading 8.77 lbs./ft.² (42.8 kg./m.²). Weight empty 1189 lbs. (578 kg.). Useful load 565 lbs. (274 kg.). Gross weight 1774 lbs. (862 kg.). Fuel 27 gals. (102 lit.). Oil 3 gals. (11.4 lit.).

**Engine.** Kinner R-5, 160 h.p. at 1975 r.p.m.

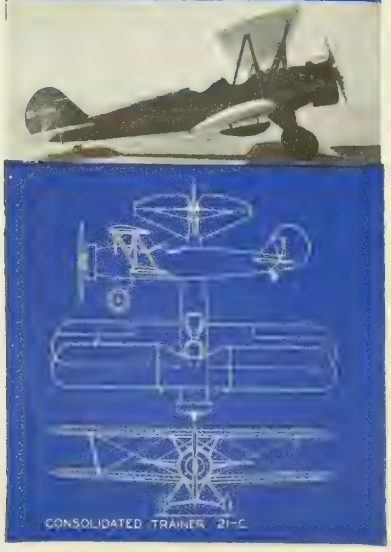
**Performance.** Maximum speed 127 m.p.h. (204 k.p.h.). Cruising speed 104 m.p.h. (167 k.p.h.). Landing speed 45 m.p.h. (72.5 k.p.h.). Service ceiling 17,580 ft. (5360 m.). Climb per min. at sea level 1178 ft. (359 m.). Cruising range 350 mi. (560 km.).

**Construction.** Fuselage: chrome molybdenum welded steel tubing; fabric covered; non-detachable engine mount; tandem seating arrangement with dual controls; baggage compartment aft of rear cockpit. Wings: fabric covered laminated spars; heat treated aluminum alloy stamping ribs; fabric covered by independent attachment to upper and lower cap strips of ribs by screw and washer arrangement; interplane bracing comprises streamlined chrome molybdenum steel tubing external struts and streamlined tie rods; rear outer struts and left center section diagonal strut adjustable for rigging; ailerons on lower wing only; balanced by hinging aft of leading edge; construction spruce and plywood, fabric covered. Tail group: aluminum alloy tubular spars, stamped sheet steel ribs; fabric covered; stabilizer adjustable in flight; fin adjustable on ground; fin cambered on one side. Leaf spring tail skid.

**Standard equipment.** Curtiss propeller, 8.50 × 10 tires, Autofan brakes, fire extinguisher, Pyralin windshield, first aid kit, leather upholstered cowling around cockpit.

**Instruments.** Pioneer altimeter type B-10, compass type B-8; tachometer type C-2, oil pressure gauge type B-2, oil temperature gauge type A-5.

*Other data in Aug., 1935,* AERO DIGEST




## CONSOLIDATED Model 21C

2-place **TRAINER**

**Specifications.** Span 31′ 6″ (9.6 m.). Length 26.5′ (7.8 m.). Height 9′ 4.5″ (2.8 m.). Wing area 280.5 ft.² (26.1 m.²). Power loading 7.95 lbs./h.p. (3.6 kg./h.p.). Wing loading 11.35 lbs./ft.² (55.5 kg./m.²). Weight empty 2160 lbs. (980 kg.). Useful load 1026 lbs. (465 kg.). Gross weight 3186 lbs. (1440 kg.). Fuel 93 gals. (352 lit.). Oil 9 gals. (34 lit.).

**Engine.** P & W Wasp Junior SB, 400 h.p. at 2200 r.p.m. at 5000 ft. (1524 m.).

**Performance.** Maximum speed 157 m.p.h. (252 k.p.h.). Cruising speed 131 m.p.h. (211 k.p.h.) at 1925 r.p.m. Landing speed 61 m.p.h. (98 k.p.h.). Service ceiling 15,200 ft. (4625 m.). Climb per min. at sea level 993 ft. (302 m.). Cruising range 542 mi. (852 km.).

**Construction.** Fuselage: chrome molybdenum welded steel tubing; fabric covered; detachable engine mounting; tandem seating arrangement with dual controls; baggage compartment behind rear cockpit; instruments in both cockpits. Wings: heat treated dural ribs; laminated solid wood spars; fabric covered; fittings heat treated chrome molybdenum steel; N-22 wing section; equal span biplane with wide center section panel and conventional ailerons on lower panels; *N*-type steel tube center section and interplane struts. Tail group: welded steel tubing; fabric covered; main structural members tubular steel; ribs stamped and tubular sections; balanced rudder. Fully swivelling tail wheel. Streamlined underslung fuel tank. Split type landing gear.

**Standard equipment.** Hamilton Standard propellers, streamline wheels and tires, Autofan brakes, oleo spring shock absorbers, ball bearings for engine and plane controls, hand type fire extinguisher, laminated glass windshield, hand inertia starter, rear view mirror, life preserver cushions, safety belts.

**Instruments.** Sensitive altimeters type C-5, clock type A-6, tachometer type C-2, airspeed indicator type B-2, compass type B-8, engine gauge unit type B-1.

*Other data in Aug., 1935,* AERO DIGEST

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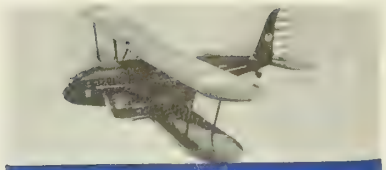
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## CURTISS-WRIGHT BT-32A — 4-place — BOMBER

**Specifications.** Span 82′ (25 m.). Length 52.25′ (15.92 m.). Height 16.33′ (4.98 m.). Wing area 1328 ft.² (123.3 m.²). Power loading 12.2 lbs./h.p. (5.45 kg./h.p.). Wing loading 13.9 lbs./ft.² (68 kg./m.²). Weight empty 11,545 lbs. (5237 kg.). Useful load 6955 lbs. (3155 kg.). Gross weight 18,500 lbs. (8392 kg.). Fuel 350 gals. (1324.9 lit.). Oil 30 gals. (113.6 lit.).
**Engines.** Wright Cyclone GR-1820F-52 (two), 760 h.p. at 2100 r.p.m.
**Performance.** Maximum speed 181 m.p.h. (291 k.p.h.). Cruising speed 164 m.p.h. (264 k.p.h.). Stalling speed 64 m.p.h. (103 k.p.h.). Service ceiling 21,000 ft. (6400 m.). Climb per min. 1290 ft. (393.2 m.). Cruising range 1400 mi. (2253.2 km.).
**Construction.** Fuselage: welded chrome molybdenum steel tubing, fabric covered; treated against corrosion, cabin floor structure fabricated from dual stringers and arches, riveted into sections attaching to clamps on lower longerons and keel; pilots' compartment floor consists of dural corrugated section covered with flat dural plate; Wings: NACA 2412 section; built-up Warren truss, chrome molybdenum steel tubing spars; truss type ribs formed from dural bulb section or dural tubing; leading edge dural covered, balance fabric covered. Tail group: chrome molybdenum steel tubing; fabric covered, Retractable landing gear.
**Standard equipment.** Hamilton Standard constant speed propellers, mechanical brakes, oleo shock absorbers, flares, Lux fire extinguisher and engine fire extinguishing system, flares, landing and navigation lights, Bendix wheels and brakes, Goodrich tires, Eclipse starter and generator, fuselage and wing bomb racks, machine gun mountings, provision for aerial camera.
**Instruments.** Sperry gyro-horizon, directional gyro; compass, sensitive altimeters, airspeed, turn and bank and rate climb indicators, tachometers, oil pressure, oil temperature, electric fuel, fuel pressure gauge, engine head temperature gauges, ammeters, clock.

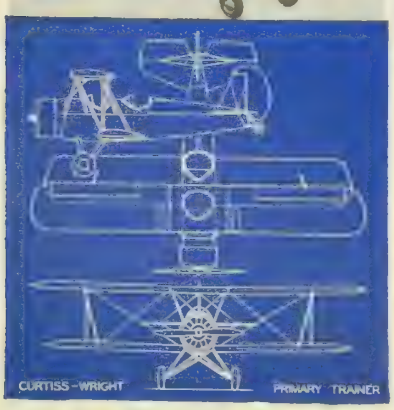





## CURTISS-WRIGHT 19R — 2-place — BASIC TRAINER

**Specifications.** Span 35′ (10.7 m.). Length 26.5′ (8.1 m.). Height 9.75′ (3 m.). Wing area 174 ft.² (16.2 m.²). Power loading 6.8 lbs./h.p. (3.1 kg./h.p.). Wing loading 16.4 lbs./ft.² (80 kg./m.²). Weight empty 1980 lbs. (898 kg.). Useful load 869 lbs. (394 kg.). Gross weight 3200 lbs. (1452 kg.). Fuel 70 gals. (264.9 lit.). Oil 6.5 gals. (24.6 lit.).
**Engine.** Wright Whirlwind R975E-3, 420 h.p. at 2200 r.p.m.
**Performance.** Maximum speed 212 m.p.h. (342 k.p.h.). Cruising speed 194 m.p.h. (312 k.p.h.). Service ceiling 22,900 ft. (6980 m.). Cruising range 460 mi. (740 km.).
**Construction.** Fuselage: all-metal 24S-T; semi-monocoque with Alclad stressed skin and longitudinal stringers, transverse bulkheads and rings; tandem seating arrangement, dual controls; transparent coupe top in three sections, front and rear sections telescoping into center section; firewall consists of two metal sheets with asbestos lining between. Wing: cantilever, all-metal 24S-T; Curtiss-Wright airfoil section, tapering in planform and thickness; three sections; outer panels and center section; attached to fuselage through riveted channel on fillet and a riveted attachment of each bulkhead to wing skin; built-up of 5 shear spars with ribs spaced along span at about 20″ intervals; multi-cellular stressed skin type construction, with ribs and spars carrying shear loads and skin and reinforcing members carrying tension and compression loads. Split trailing edge type flaps extended 55% of span; ailerons all-metal stressed skin, dynamically and statically balanced. Tail group: all-metal, 24S-T; cantilever; fin and stabilizer integral with fuselage. Fixed type landing gear.
**Standard equipment.** Curtiss-Reed or Hamilton Standard propeller, NACA cowl, oleo shock absorbers, hydraulic brakes, battery, navigation lights, battery.
**Instruments.** Airspeed indicator (2), tachometer (2), altimeter (2), engine gauge unit (2), bank and turn and rate of climb indicators, clock.



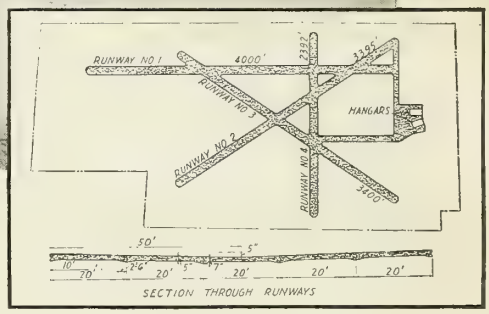



## CURTISS-WRIGHT Trainer — 2-place — PRIMARY TRAINER

**Specifications.** Span, upper wing 28′ 10″ (8.8 m.); lower wing 26′ 4″ (8 m.). Length 20′ 4″ (6.3 m.). Height 8′ 7″ (2.6 m.). Wing area 206 ft.² (19.1 m.²). Power loading 11.1 lbs./h.p. (5 kg./h.p.). Wing loading 9.5 lbs./ft.² (46.3 kg./m.²). Weight empty 1320 lbs. (599 kg.). Useful load 630 lbs. (286 kg.). Gross weight 1950 lbs. (885 kg.). Fuel 33 gals. (124.9 lit.). Oil 4 gals. (15 lit.).
**Engine.** Wright Whirlwind R-540, 175 h.p. at 2000 r.p.m.; stressed to take power plants ranging from 90 h.p. to 175 h.p.
**Performance.** Maximum speed 127 m.p.h. (204 k.p.h.). Cruising speed 108 m.p.h. (173 k.p.h.). Landing speed 47 m.p.h. (76 k.p.h.). Service ceiling 17,200 ft. 5250 m.). Climb per min. 950 ft. (290 m.). Cruising range 307 mi. (494 km.).
**Construction.** Fuselage: welded chrome molybdenum steel tubing; fabric covered; treated to prevent corrosion; tandem seating arrangement; dual controls; fittings and attaching brackets for engine mount, wings, landing gear, tail wheel or skid welded integral. Wings: solid spruce spars; spruce and mahogany ribs, Warren truss type; fabric covered; Clark Y-15 airfoil section; wings stagger 28°; leading edge dural covered; trailing edge formed by rigid Hyblum channel; aileron spar is box section, ribs constructed of spruce. Tail group: welded steel tubing, fabric covered; fin constructed of 2 steel spars, with welded steel tubing ribs integral with spars; rudder steel tubing, welded and equipped with overhung balance; horizontal stabilizer steel tubing ribs, and adjustable in flight; elevators braced by tie rods. Fixed split axle type landing gear; center Vee attaches at upper ends to lower fuselage longerons.
**Standard equipment.** Wood propeller, fire extinguisher, Hydro-Flex oleo shock absorbers, 6.50 × 10 low pressure tires, Pyralin windshield, wiring for navigation lights, tail skid. Tail wheel optional in which case wheel brakes are suggested.
**Instruments.** Altimeter, tachometer, oil pressure gauge.



*Giving a concrete runway the smooth riding surface and non-skid texture so essential to safe landing. Dayton, Ohio, airport. F. O. Eichelberger, city manager; George F. Baker, director of service and buildings; H. J. Derivan, district director of WPA.*




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## CURTISS Seagull — 2-place — SCOUT-OBSERVATION

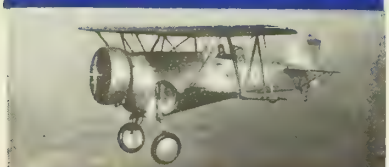
**Specifications.** Span 36′ (10.96 m.). Length 26.5′ (8.08 m.). Height 13.07′ (3.99 m.). Wing area 342 ft.² (31.8 m.²). Power loading 9.44 lbs./h.p. (4.28 kg./h.p.). Wing loading 15.2 lbs./ft.² (74.1 kg./m.²). Weight empty 3543 lbs. (1607.1 kg.). Useful load 1649 lbs. (747.9 kg.). Gross weight 5192 lbs. (2355 kg.). Fuel 144 gals. (545.1 lit.). Oil 10 gals. (37.8 lit.).
**Engine.** P & W Wasp S3H1, 550 h.p. at 2200 r.p.m. at 5000 ft. (1525 m.).
**Performance.** Maximum speed at 5000 ft. (1525 m.). 168 m.p.h. (270 k.p.h.); at sea level 156 m.p.h. (251 k.p.h.). Cruising speed at 5000 ft. (1525 m.) 137.3 m.p.h. (221 k.p.h.). Stalling speed 57.5 m.p.h. (92.5 k.p.h.). Service ceiling 16,070 ft. (4898.1 m.). Cruising range at 5000 ft. 697 mi. (1122 km.).
**Construction.** Fuselage: welded chrome molybdenum steel tubing; fabric covered aft of aluminum alloy cowling; tandem seating arrangement; sliding cabin enclosures for both cockpits; dual controls; top cowling from rear cockpit of metal with collapsing turbleback. Wings: spars and ribs, aluminum alloy; fabric covered except for portion ahead of front spars; two upper-outer panels, two lower panels and center section; slots on upper outer and center panels are all-metal with aluminum alloy covering; wings folding type; streamlined aluminum alloy tubing interplane struts. Aluminum alloy fabric covered flaps on upper-outer panel trailing edge. Tail group: stabilizer and fin, all-metal, aluminum alloy covered; full cantilever fin, semi-cantilever stabilizer; rudder and elevators aluminum alloy structure, fabric covered. Fixed type landing gear.
**Standard equipment.** Curtiss propeller, oleo shock absorbers, mechanical brakes, generator and battery, navigation lights, bonding, fire extinguisher, provision for machine guns, bombs and aerial camera, starter.
**Instruments.** Sperry directional gyro, gyro-horizon; airspeed indicator, altimeter clock, compass, engine gauge unit, fuel gauge, tachometer, turn and bank indicator, air intake thermometer, inclinometer.






## CURTISS Shrike A-12 — 2-place — ATTACK

**Specifications.** Span 44′ (13.4 m.). Length 31.5′ (9.6 m.). Height 9.4′ (2.9 m.). Wing area 285 ft.² (26.7 m.²). Power loading 7.64 lbs./h.p. (3.47 kg./h.p.). Wing loading 20.8 lbs./ft.² (100.7 kg./m.²). Weight empty 4024 lbs. (1825.3 kg.). Useful load 1901 lbs. (862.3 kg.). Gross weight 5925 lbs. (2687.6 kg.). Fuel 114 gals. (431.5 lit.). Oil 8 gals. (30.3 lit.).
**Engine.** Wright Cyclone SR-1820F-52, 775 h.p. at 2100 r.p.m.
**Performance.** Maximum speed 202 m.p.h. (325.1 k.p.h.). Cruising speed 171 m.p.h. (275.2 k.p.h.). Service ceiling 20,700 ft. (6310 m.). Cruising range 481.5 mi. (775 km.).
**Construction.** Fuselage: all-metal; forward part back to rear of cockpit, welded steel tubing; rear portion aluminum alloy monocoque; sections joined by telescoping longeron stubs of fore section into U channels of aft section; monocoque section consists of bulkheads J-section stringers, smooth dural skin; tandem seating arrangement; rear cockpit provided with sliding canopy top. Wing: all-metal; hollow box spars built up of corrugated webs and cap strips with internal bulkheads; ribs are of truss type with J-section cap strips and truss members of rolled W-section; smooth skin covering. Leading edge slots and trailing edge flaps; ailerons balanced. Tail group: all-metal; dural channel sections; rudder and elevators fabric covered; fin and stabilizer, metal covered; stabilizer adjustable in flight; rudder provided with trimming tab; elevator built up of 2 separate parts; each consists of front spar of dural section with sheet dural ribs rivetted to it. Fixed individual leg type landing gear.
**Standard equipment.** Hamilton Standard three-bladed propeller, streamline tires, Bendix brakes, parking brake, battery, navigation lights, shielding and bonding, fire extinguisher, fixed and flexible gun mounts, machine guns (5), bomb release equipment.
**Instruments.** Airspeed indicator, tachometer, altimeter, compass, turn and bank indicator, engine gauge unit, clock, volt-ammeter.



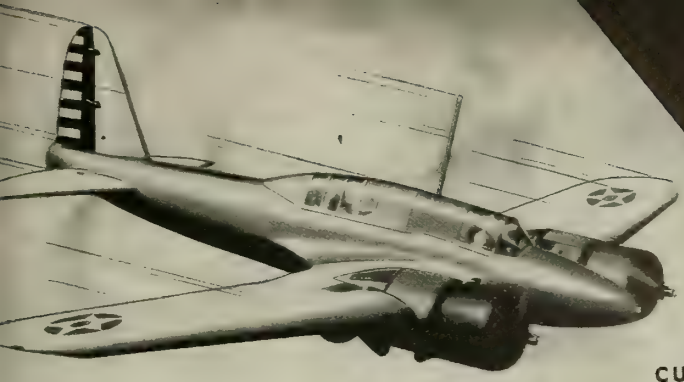



## CURTISS Hawk III — 1-place — FIGHTER

**Specifications.** Span 31.5′ (9.6 m.). Length 23′ 6″ (7.2 m.). Height 9.95′ (3.04 m.). Wing area 262 ft.² (24.35 m.²). Power loading 5.75 lbs./h.p. (2.61 kg./h.p.). Wing loading 16.5 lbs./ft.² (80.4 kg./m.²). Weight empty 3213 lbs. (1457 kg.). Useful load 1104 lbs. (501 kg.). Gross weight 4317 lbs. (1958 kg.). Fuel 110 gals. (416 lit.). Oil 9 gals. (34.1 lit.).
**Engine.** Wright Cyclone SR-1820F-53, 750 h.p. at 2100 r.p.m.
**Performance.** Maximum speed 240.2 m.p.h. (386.5 k.p.h:) at critical altitude. Cruising speed 202.9 m.p.h. (326.5 k.p.h.). Stalling speed at sea level 67.9 m.p.h. (109.2 k.p.h.). Service ceiling 25,800 ft. (7880 m.). Cruising range 575 mi. (925 km.).
**Construction.** Fuselage: welded steel tubing; fabric covered; front and rear sections full tubular truss construction with welded joints and steel forgings for complicated fittings; welded tubular structure for engine mount. Wings: upper wing one continuous panel; spars hollow box section with spruce upper and lower flanges and plywood web; ribs built-up wood trusses with spruce flanges and diagonal bracing and plywood webs; ailerons sheet duralumin frame, fabric covered; on upper panel only; wing may be specially constructed to provide for installation of emergency flotation equipment. Tail group: all-metal internal structure, fabric covered; fin adjustable on ground; rudder equipped with Flettner-type trim tab; stabilizer adjustable in flight; elevators balanced. Fully swivelling tail wheel. Fully retractable landing gear fits into wheel wells on sides of fuselage forward of lower wing.
**Standard equipment.** Hamilton Standard three-bladed propeller, Eclipse starter, gun mounts, bombing equipment, machine gun equipment, fire extinguisher, oxygen equipment, flares battery, navigation lights.
**Instruments.** Airspeed indicator, tachometer, altimeter, compass, clock, engine gauge unit, turn and bank and landing gear position indicators manifold pressure gauge, engine cylinder temperature indicator.

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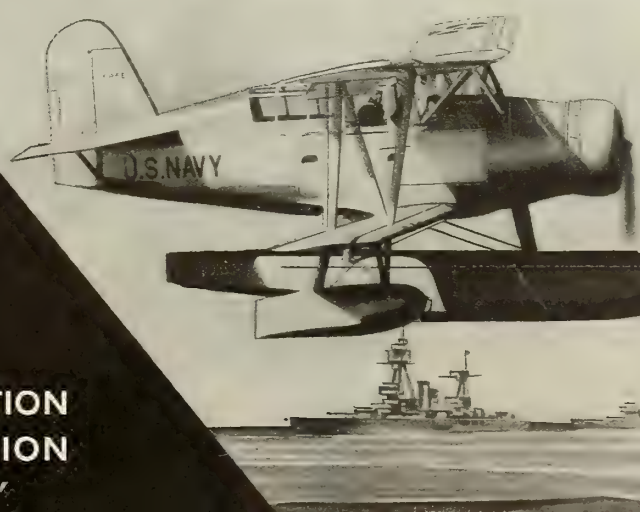
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**U.S. NAVY**
**CURTISS SBC-3**

A large number of Scout-Bombers of this type are now being built for the U.S. Navy Department's Bureau of Aeronautics.




**U.S. NAVY**
**CURTISS SOC-1**

175 Scout-Observation planes of this type have been purchased by the U.S. Navy Department's Bureau of Aeronautics.

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## CURTISS Hawk IV

1-place

**FIGHTER**

**Specifications.** Span 31.5′ (9.6 m.). Length 23.5′ (7.17 m.). Height 10.10′ (3.08 m.). Wing area 262 ft.² (24.35 m.²). Power loading 6.17 lbs./h.p. (2.8 kg./h.p.). Wing loading 17.55 lbs./ft.² (85.7 kg./m.²). Weight empty 3404 lbs. (1544 kg.). Useful load 1194 lbs. (541.6 kg.). Gross weight 4598 lbs. (2085.8 kg.). Fuel 110 gals. (416.4 lit.). Oil 9 gals. (34.1 lit.).
**Engine.** Wright Cyclone SR-1820F-56, 745 h.p. at 2100 r.p.m.
**Performance.** Maximum speed at 12,500 ft. (3810 m.) 248.5 m.p.h. (400 k.p.h.); at 16,400 ft. (5000 m.) 242.3 m.p.h. (390 k.p.h.); at sea level 204.5 m.p.h. (329 k.p.h.). Cruising speed at 12,500 ft. (3810 m.) 211.3 m.p.h. (340 k.p.h.). Stalling speed 69.3 m.p.h. (111.5 k.p.h.). Service ceiling 29,700 ft. (9050 m.). Climb per min. 2185 ft. (666 m.). Cruising range at 12,500 ft. (3810 m.). 577 mi. (928 km.).
**Construction.** Fuselage: chrome molybdenum steel tubing; in three sections bolted and riveted together; steel forgings integral, with steel bushings at all important fittings; transparent canopy top. Wings: upper unit continuous panel; hollow box type spars with spruce and ash upper and lower flanges and plywood web, internally braced and reinforced; ribs built-up wood trusses using spruce flanges and diagonal bracing and plywood webs; upper panel attached to fuselage by cabane structure of streamline struts and wires: Tail group: all-metal structure, fabric covered. Fully retractable landing gear, manually operated.
**Standard equipment.** Hamilton Standard controllable-pitch propeller, oleo shock absorbers, brakes, fire extinguisher, oxygen equipment, provision for installation of 2 fixed machine guns, provision for bomb installation, Eclipse starter.
**Instruments.** Airspeed indicator, tachometer, altimeter, compass, clock, engine gauge unit, oil temperature gauge, turn and bank indicator, manifold pressure gauge, landing gear position indicator, cylinder head temperature indicator.



## CURTISS Hawk 75

1-place

**PURSUIT**

**Specifications.** Span 37.3′ (11.36 m.). Length 28.1′ (8.56 m.). Height 9.3′ (2.82 m.). Wing area 236 ft.² (21.95 m.²). Power loading 6.16 lbs./h.p. (2.79 kg./h.p.). Wing loading 21.9 lbs./ft.² (107 kg./m.²). Weight empty 3984 lbs. (1807 kg.). Useful load 1188 lbs. (539 kg.). Gross weight 5172 lbs. (2346 kg.). Fuel 107 gals. (405 lit.). Oil 9 gals. (34.1 lit.).
**Engine.** Wright Cyclone SGR-1820G-3, 840 h.p. at 2100 r.p.m. at 10,700 ft. (3250 m.).
**Performance.** Maximum speed at sea level 238.6 m.p.h. (384 k.p.h.); at 10,700 ft. (3250 m.) 273.4 m.p.h. (440 k.p.h.). Cruising speed at 10,700 ft. 234.3 m.p.h. (370 k.p.h.) Stalling speed 68 m.p.h. (109.4 k.p.h.) Service ceiling 31,400 ft. (9570 m.). Climb per min. 2340 ft. (713.2 m.). Cruising range at 10,700 ft. 547 mi. (880 km.).
**Construction.** Fuselage: all-metal; semi-monocoque with Alclad stressed skin reinforced by transverse bulkheads, stiffeners and longitudinal stringers; sliding canopy top. Wing: all-metal; tapers in plan form and thickness; NACA 2215 airfoil section at root tapering to 2209 section at tip; internal structure of longitudinal stringers, shear spars and fore and aft ribs riveted to smooth stressed skin; detachable tips; continuous across fuselage under cockpit and provided with I-section keel on lower surface centerline; ailerons of aluminum alloy spars and ribs, fabric covered. Flaps are all-metal of split type trailing edge, hydraulically operated. Tail group: all-metal; aluminum alloy spars and ribs; rudder and elevators, fabric covered; cantilever stabilizer and fin, aluminum alloy covered. Fixed landing gear.
**Standard equipment.** Curtiss constant speed fully feathering propeller, streamline tires, navigation lights, fire extinguisher, Plexiglas windshield and cabin enclosure, hand inertia starter, generator, machine gun mounts, bomb release handles, bomb rack controls.
**Instruments.** Altimeter, thermocouple, manifold pressure gauge, clock, fuel gauge, engine gauge unit, directional gyro, airspeed, turn and bank, rate of climb indicators, compass, exhaust gas analyzer.



## GRUMMAN JF-2

2-place

**MILITARY-PHOTOGRAPHIC**

**Specifications.** Span 39′ (11.9 m.). Length 33′ (10.1 m.). Height 12′ 8″ (3.9 m.). Wing area 409 ft.² (38 m.²). Power loading 8.05 lbs./h.p. (3.7 kg./h.p.). Wing loading 13.6 lbs./ft.² (66.4 kg./m.²). Weight empty 3919 lbs. (1777.7 kg.). Useful load 1727 lbs. (783.4 kg.). Gross weight 5646 lbs. (2561.1 kg.) Fuel 150 gals. (565.1 lit.). Oil 11 gals. (41.3 lit.).
**Engine.** Wright Cyclone, 700 h.p. at 1950 r.p.m.
**Performance.** Maximum speed 170 m.p.h. (273.6 k.p.h.). Landing speed 63 m.p.h. (101.4 k.p.h.). Service ceiling 20,000 ft. (6094 m.). Climb per min. 1400 ft. (476.7 m.).
**Construction.** Amphibion. Fuselage: aluminum alloy, semi-monocoque construction. Wings: aluminum alloy spars and ribs; fabric covered; bracing N-type interplane struts, end struts and cross wires at center section; lift bracing consists of two flying wires in the same plane with double landing wires; ailerons on upper and lower wings; upper wing consists of two panels joined at center; lower wings have wing tip floats. Tail group: aluminum alloy; fixed surfaces metal covered, strut braced to fin; movable surfaces fabric covered; rudder has fixed tab; elevators provided with trim tab control. Fully swivelling tail wheel. Fully retractable landing gear.
**Standard equipment.** Hamilton Standard three-blade propeller, Eclipse starter, Goodrich landing gear tires, Goodyear tail wheel, Bendix wheels and mechanical brakes, Cleveland Pneumatic aerol shock absorbers, Fafnir and Norma-Hoffmann bearings for plane controls, navigation lights, landing lights, Lux fire extinguisher, flares, Pittsburgh Plate laminated glass for windshield, Plastacelle for coupé top enclosure, first aid equipment, throttle controls AN standard.
**Instruments.** Altimeter type AN5718, sensitive altimeter type AN5728, clock, fuel gauge type NAF 39908, engine gauge unit type AN5521, tachometer, directional gyro, airspeed and turn and bank indicators, compass, thermocouple, wheel position indicator; Weston carburetor temperature gauge, volt-ammeter type A-1.

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## GRUMMAN F2F-1

1-place

**FIGHTER**

**Specifications.** Span 28′6″ (8.7 m.). Length 21′4.87″ (6.5 m.). Height 8′6″ (2.6 m.). Wing area 230 ft.² (21.4 m.²). Power loading 5.85 lbs./h.p. (2.6 kg./h.p.). Wing loading 16.5 lbs./ft.² (80.6 kg./m.²). Empty weight 2630 lbs. (1193 kg.). Useful load 1160 lbs. (526.1 kg.). Gross weight 3790 lbs. (1719.1 kg.). Fuel 110 gals. (416.4 lit.). Oil 9 gals. (34.1 lit.).

**Engine.** Pratt & Whitney R-1535-72, twin-row Wasp Junior, 650 h.p. at 2200 r.p.m. at 7500 ft. (2286 m.); 700 h.p. available for take-off at 2200 r.p.m.

**Performance.** Maximum speed 240 m.p.h. (386.2 k.p.h.). Cruising speed 210 m.p.h. (337.9 k.p.h.). Landing speed 64 m.p.h. (103 k.p.h.). Service ceiling 27,500 ft. (8382 m.). Climb per min. 2500 ft. (762 m.).

**Construction.** Fuselage: all-metal aluminum alloy, semi-monocoque construction; sliding transparent canopy top. Wing: aluminum alloy spars and ribs; fabric covered; stainless steel flying and landing wires; upper wing consists of two panels hinged at center and attached to fuselage by two cabane struts on each side; ailerons on upper panels only; streamlined N-type interplane struts. Tail group: all-metal construction of aluminum alloy; stabilizer strut-braced to fin; fabric covered elevators and rudder. Fully retractable landing gear, manually operated. Retractable tail wheel.

**Standard equipment.** Hamilton Standard 8′6″ diameter controllable pitch propeller, Goodrich tires, Bendix brakes and shock absorbers, battery, Fafnir and Norma-Hoffmann bearings for engine and plane controls, navigation lights, Adams & Westlake landing lights, Kidde fire extinguisher, non-shatterable windshield, Plastecele enclosure, Eclipse starter.

**Instruments.** Sensitive altimeter, thermocouple, manifold pressure gauge, clock, fuel gauge, fuel pressure, oil pressure and oil temperature gauges, tachometer, ammeter, Sperry directional gyro, Sperry gyro-horizon, air-speed indicator, compass, Pioneer turn and bank indicator, carburetor temperature gauge. *Other data in February* 1936, AERO DIGEST.






## GRUMMAN FF-1

2-place

**FIGHTER**

**Specifications.** Span 34′ 6″ (10.5 m.). Length 24′ 6″ (7.6 m.). Height 9′ 5″ (2.9 m.). Wing area 310 ft.² (28.8 m.²). Power loading 6.22 lbs./h.p (2.8 kg./h.p.). Wing loading 15.5 lbs./ft.² (74.7 kg./m.²). Weight empty 3221 lbs. (1461 kg.). Useful load 1579 lbs. (716.2 kg.). Gross weight 4800 lbs. (2177.2 kg.). Fuel 120 gals. (454.3 lit.). Oil 8.5 gals. (32.2 lit.).

**Engine.** Wright Cyclone, 770 h.p. at 2100 r.p.m. at 5800 ft. (1767.8 m.).

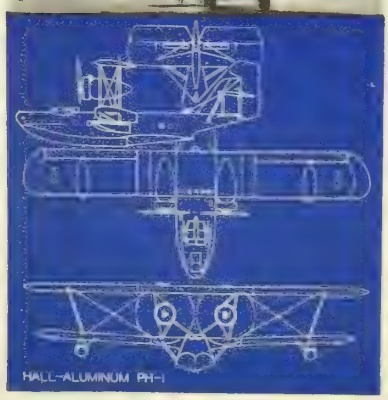
**Performance.** Maximum speed 216 m.p.h. (347.6 k.p.h.). Landing speed 65 m.p.h. (104.6 k.p.h.). Service ceiling 22,500 ft. (6858 m.). Climb per min. 1600 ft. (487.7 m.). Cruising range 647 mi. (1031.3 km.).

**Construction.** Fuselage: aluminum alloy, semi-monocoque construction; sliding coupé top; tandem seating arrangement; dual controls. Wings: aluminum alloy spars and ribs; fabric covered; bracing *N*-type interplane struts, end struts and cross wires at center section; lift bracing consists of two flying wires in the same plane with double landing wires; ailerons on upper wing panels only; upper wing consists of two panels joined at center; gulled and cut-away to assist visibility. Tail group: aluminum alloy; fixed surfaces strut braced to fin. Fully retractable landing gear, manually retracted. Tail wheel.

**Standard equipment.** Hamilton Standard propeller, Eclipse starter, Goodrich tires, Bendix wheels and mechanical brakes, Cleveland Pneumatic Aerol shock absorbers, storage battery, Fafnir and Norma-Hoffmann ball bearings for plane controls, navigation lights, Adams & Westlake landing lights, Kidde fire extinguisher, flares, laminated windshield glass, Plastecelle coupé top, first aid equipment, throttle controls AN standard.

**Instruments.** Altimeter type AN5728, clock type AN5726, Mark V compass, manifold pressure gauge type NAF 39913, tachometer type AN5513, airspeed indicator type AN5706-2, turn and bank indicator type NAF 39905, engine gauge unit type AN5521, thermocouple, fuel gauge type NAF 39908, wheel position indicator; Weston ammeter.






## HALL ALUMINUM PH-1

4-place

**PATROL-BOMBER**

This model may also be converted to carry 14 passengers.

**Specifications.** Span 72′ 10″ (22.2 m.). Length 51′ 1.187″ (15.57 m.). Height 17′ 6.75″ (5.34 m.). Wing area 1170 ft.² (108.5 m.²). Power loading 10.5 lbs./h.p. (4.8 kg./h.p.). Wing loading 13.6 lbs./ft.² (66.4 kg./m.²). Weight empty 8719 lbs. (3955 kg.). Useful load 7281 lbs. (3300 kg.). Gross weight 16,000 lbs. (7260 kg.). Fuel 750 gals. (2840 lit.). Oil 42 gals. (1588 lit.). Fuel load can be increased to 900 gals. (3406.9 lit.) and oil to 60 gals. (227.1 lit.) in which event the gross weight becomes 17,035 lbs.

**Engines.** Wright Cyclone SGR-1820F-52 (two), 760 h.p. at 2100 r.p.m. at 5800 ft. (1767.8 m.).

**Performance.** Maximum speed at sea level 147.5 m.p.h. (237.2 k.p.h.); at 5800 ft. (1767.8 m.). 160 m.p.h. (257.5 k.p.h.). Cruising speed at 5800 ft. (1767.8 m.) 138 m.p.h. (221 k.p.h.). Landing speed 60 m.p.h. (96.5 k.p.h.). Service ceiling 21,000 ft. (6400 m.). Climb per min. 1150 ft. (351 m.). Cruising range (normal) 1740 mi. (2800 km.).

**Construction.** Hull: aluminum alloy, riveted. Wings: aluminum alloy structure, fabric covered; Clark Y airfoil section; braced by struts and wires. Tail group: aluminum alloy structure, fabric covered; braced by struts and wires.

**Standard equipment.** Hamilton Standard 3-bladed propellers, battery, ball bearing surface controls, navigation lights, Pyle-National landing lights, fire extinguisher, flares, safety glass windshield and cabin enclosure, starter, radio bonding and shielding.

**Instruments.** Pioneer or Kollsman sensitive altimeters, airspeed and rate of climb indicators; Pioneer, Kollsman or U. S. Gauge fuel pressure and oil pressure gauges; Weston or Kollsman tachometers; Weston thermocouples, ammeter, carburetor temperature gauge; Elgin clock; Pioneer fuel gauges, turn and bank indicators, compasses; air temperature gauge; Sperry directional gyro and gyro-horizon; oil temperature gauges; air temperature gauge.




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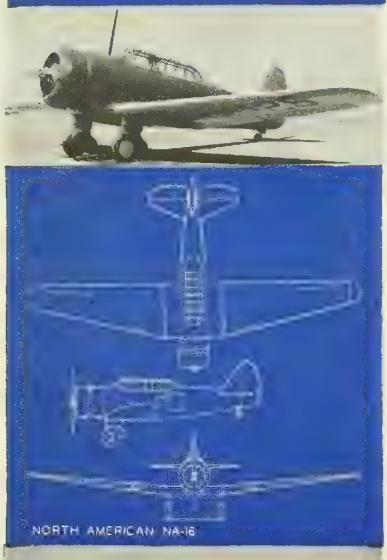
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## MARTIN 139-W

4-place **BOMBER**

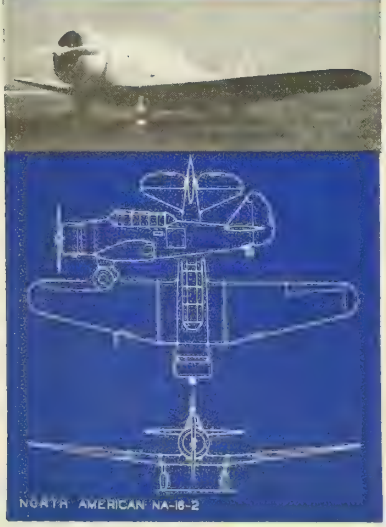
**Specifications.** Span 70.5′ (21.5 m.). Length 44.73′ (13.6 m.). Height 11.5′ (3.5 m.). Wing area 678.ft.² (63 m.²). Power loading 8.74 lbs./h.p. (3.97 kg./h.p.). Wing loading 21.7 lbs./ft.² (106 kg./m.²). Weight empty 9205 lbs. (4175 kg.). Useful load 5264 lbs. (2387.8 kg.). Payload 2966 lbs. (1345.4 kg.). Gross weight 14,675 lbs. (6647 kg.). Fuel 452 gals. (1711 lit.). Oil 63 gals. (238.5 lit.).
**Engine.** Wright GR-1820G-3 (two), 840 h.p. at 2100 r.p.m. at 8700 ft. (2651.8 m.).
**Performance.** Maximum speed 235 m.p.h. (378 k.p.h.). Cruising speed 210 m.p.h. (337.9 k.p.h.) at 10,000 ft. (3050 m.). at 75% power. Landing speed with flaps 65 m.p.h. (104.6 k.p.h.); without flaps 70 m.p.h. (112.6 k.p.h.). Climb per min. 1700 ft. (518.2 m.). Service ceiling 26,000 ft. (7925 m.). Cruising range at 200 m.p.h. average (322 km./hr.) hours, 5.48 at 10,000 ft. (3050 m.).
**Construction.** Fuselage: 24S-T riveted aluminum alloy monocoque construction built in three sections; wing center section is permanently secured to and is part of the fuselage center section. Wing: box type aluminum alloy construction; three panels; outer panels tapered, center section straight. Split trailing edge type flaps hydraulically operated. Tail group: fixed cantilever horizontal and vertical stabilizers, aluminum alloy construction and covering; rudder and elevators fabric covered. Fully retractable landing gear, manually and electrically operated. Fully swivelling tail wheel.
**Standard equipment.** Hamilton Standard controllable-pitch or constant speed propellers, streamlined tires, battery, navigation and landing lights, two-way radio, radio compass, interphone set, fire extinguisher, flares, electric starters.
**Instruments.** Sensitive altimeter, thermocouple, clock, tachometer, ammeter, voltmeter, directional gyro, gyro-horizon, compass, air temperature, manifold pressure, oil pressure, oil temperature gauges, airspeed, turn and bank, rate of climb flap and gear position indicators.




## NORTH AMERICAN NA-16

2-place **GENERAL PURPOSE**

**Specifications.** Span 42′ (12.8 m.). Length 27′ 4.31″ (8.4 m.). Height 8′ 8″ (2.7 m.). Wing area 248 ft.² (23.1 m.²). Power loading 8.18 lbs./h.p. (3.75 kg./h.p.). Wing loading 18.1 lbs./ft.² (88.3 kg./m.²). Weight empty 3200 lbs. (1450 kg.). Useful load 1300 lbs. (635 kg.). Gross weight 4500 lbs. (2040 kg.). Fuel 104 gals. (394 lit.). Oil 9.5 gals. (36 lit.).
**Engine.** P & W Wasp Jr. S3H1, 550 h.p. at 2200 r.p.m. at 5000 ft. (1524 m.); 345 h.p. at 2050 r.p.m. at 16,000 ft. (4876.8 m.).
**Performance.** Maximum speed 206 m.p.h. (331 k.p.h.). Cruising speed 194 m.p.h. (311 k.p.h.). Landing speed with flaps 65 m.p.h. (105 k.p.h); without flaps 71 m.p.h. (114 k.p.h.). Service ceiling 26,000 ft. (7920 m.). Climb per min. 1800 ft. (550 m.). Cruising range 665 mi. (1065 km.).
**Construction.** Fuselage: chrome molybdenum steel tubing; fabric covered; removable side panels; semi-monocoque aluminum alloy bottom; removable aluminum alloy panels on top; tandem seating arrangement; sliding transparent canopy top. Wing: full cantilever type; all-metal of aluminum alloy; three sections, including center section and two outer panels; ailerons of aluminum alloy frames; fabric covered. Split trailing edge type flaps, all-metal; manually operated. Tail group: fixed surfaces, all-metal; movable surfaces, aluminum alloy frames, fabric covered; trimming tabs on elevators and rudder. Fixed type individual leg landing gear.
**Standard equipment.** Hamilton Standard 2-position controllable-pitch propeller, General Streamline tires, Hayes Autofan wheels, Bendix hydraulic brakes, Cleveland oleo shock absorbers, Exide battery, Fafnir engine and plane control bearings, Pyle-National navigation lights, S & M landing lights, Pyrene fire extinguisher, flares, L-O-F shatterproof windshield, Eclipse starter.
**Instruments.** Kollsman altimeter; Pioneer manifold pressure gauge, clock, engine gauge unit, tachometer, airspeed indicator, turn and bank indicator, compass; Weston ammeter; float type fuel gauge; flap position indicator.




## NORTH AMERICAN NA-16-2

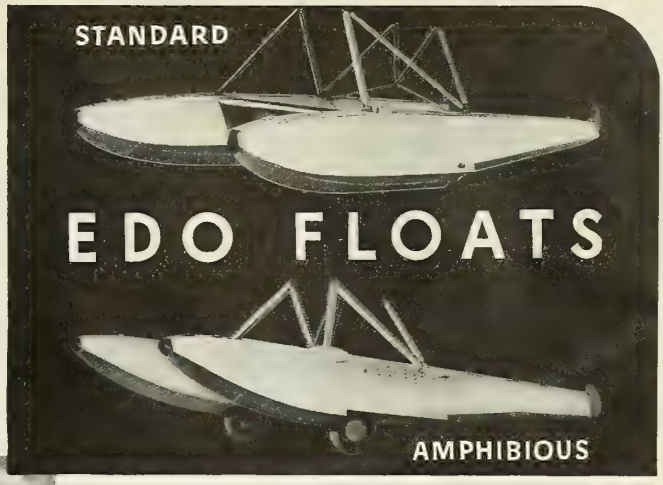
2-place **FIGHTER**

**Specifications.** Span 42′ (12.8 m.). Length 27′ 7″ (8.4 m.). Height 8′ 8″ (2.7 m.). Wing area 248 ft.² (23.1 m.²). Power Loading 9 lbs./h.p. (4.1 kg./h.p.) Wing loading 18.1 lbs./ft.² (88.3 kg./m.²). Weight empty 3065 lbs. (1390 kg.). Useful load 1435 lbs. (652 kg.). Gross weight 4500 lbs. (2040 kg.). Baggage 40 lbs. (18.2 kg.). Fuel 104 gals. (394 lit.). Oil 9.5 gals. (36 lit.).
**Engine.** P & W S6H1, 500 h.p. at 2200 r.p.m. at 11,000 ft. (3352.8 m.).
**Performance.** Maximum speed 212 m.p.h. (341 k.p.h.). Cruising speed 196 m.p.h. (316 k.p.h.) at 1880 r.p.m. Landing speed with flaps 65 m.p.h. (105 k.p.h.); without flaps 71 m.p.h. (114 k.p.h.). Service ceiling 29,000 ft. (8850 m.). Climb per min. 1670 ft. (510 m.). Cruising range 940 mi. (1515 km.).
**Construction.** Fuselage: chrome molybdenum steel tubing; fabric covered; semi-monocoque aluminum alloy bottom; tandem seating arrangement. Wing: cantilever type; all-metal construction, aluminum alloy; ailerons metal internal structure, fabric covered. Flaps split trailing edge type, manually operated. Tail group: fixed surfaces all-metal construction; movable surfaces, aluminum alloy internal structure, fabric covered; trimming tabs on elevators. Fully swivelling tail wheel.
**Standard equipment.** Hamilton Standard propellers, hand inertia starter, General Streamline tires, Autofan wheels, Bendix hydraulic brakes, Cleveland Pneumatic aerol shock absorbers, Exide battery, Fafnir sealed bearings for engine and plane controls, Pyle-National navigation lights, wiring for landing lights, Pyrene fire extinguisher, nonshatterable coupe glass, safety belts, map case, Aero Supply throttle controls.
**Instruments.** Pioneer altimeter type 743-B, tachometer type 347-124, airspeed indicator type 354-7947, turn and bank indicator type 103C-2420, compass type 356; Kollsman manifold pressure gauge type 51-01-316, fuel pressure gauge type 150-03; Weston ammeter type A-5; Lewis thermocouple type 1C-2; flap position indicator, fuel gauge.

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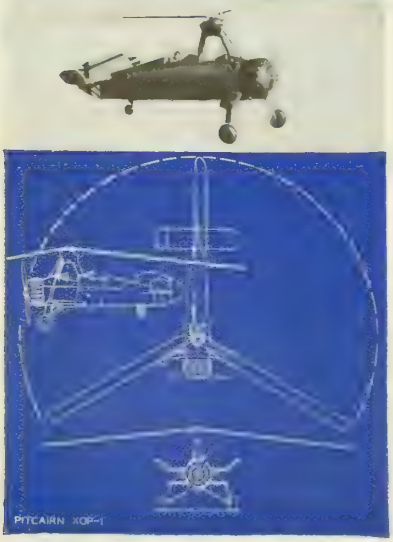

## NORTH AMERICAN NA-16-4 — 2-place — BASIC TRAINER

**Specifications.** Span 42′ (12.8 m.). Length 27′ 7″ (8.4 m.). Height 8′ 8″ (2.7 m.). Wing area 248 ft.² (23.1 m.²). Power loading 8.8 lbs./h.p. (4 kg./h.p.). Wing loading 15.6 lbs./ft.² (76.1 kg./m.²). Weight empty 2825 lbs. (1285 kg.). Useful load 1035 lbs. (471 kg.). Gross weight 3860 lbs. (1755 kg.). Fuel 104 gals. (394 lit.). Oil 9.5 gals. (36 lit.).
**Engine.** Wright Whirlwind R-975-E3, 440 h.p. at 2200 r.p.m.
**Performance.** Maximum speed 184 m.p.h. (297 k.p.h.). Cruising speed 169 m.p.h. (272 k.p.h.) at 1880 r.p.m. Landing speed with flaps 56 m.p.h. (90 k.p.h.); without flaps 61 m.p.h. (98 k.p.h.). Service ceiling 24,000 ft. (7310 m.). Climb per min. 1350 ft. (412 m.). Cruising range 920 mi. (1480 km.).
**Construction.** Fuselage: chrome molybdenum steel tubing, fabric covered sides; aluminum alloy semi-monocoque bottom aft of wing; engine mount and engine section removable as a unit; tandem seating arrangement; dual controls. Wing: center section two spar aluminum alloy construction; outer panels single spar, aluminum alloy construction. Split trailing edge type flaps. Tail group: stabilizer and fin aluminum alloy construction throughout; rudder and elevators aluminum alloy internal structure, fabric covered; trimming tabs on elevators.
**Standard equipment.** Hamilton Standard propeller, hand inertia starter, General Streamline tires, Autofan wheels, Bendix hydraulic brakes, Cleveland Pneumatic aerol shock absorbers, battery, Fafnir sealed bearings for engine and plane controls, Pyle-National navigation lights, wiring for landing lights, Pyrene fire extinguisher, non-shatterable sliding coupé top, safety belts, map case, Aero Supply throttle controls.
**Instruments.** Pioneer type 743-B altimeter, tachometer type 347-124, airspeed indicator type 354-7947, turn and bank indicator type 103C-2420, compass type 356; Kollsman engine gauge unit type 150-03; Weston ammeter type A-5; Lewis thermocouple type 1C-2; fuel gauge, flap position indicator.




## NORTH AMERICAN NA-16-5 — 1-place — FIGHTER

**Specifications.** Span 36′ (10.7 m.). Length 27′ 3.75″ (8.3 m.) Height 8′ 5.5″ (2.6 m.). Wing area 225 square feet (2.1 square m.). Power loading 21.1 lbs. per square foot (103 kg./ square m.) Weight empty 3274 lbs. (1490 kilograms). Useful load 1476 pounds (672 kilograms). Gross weight 4750 pounds (2160 kilograms). Fuel 145 gallons (550 liters). Oil 13 gallons (49.5 liters).
**Engine.** Wright Cyclone 1820 F-53, 750 h.p. at 1950 revolutions per minute at 11,000 ft. (3352.8 m.).
**Performance.** Maximum speed 250 m.p.h. (403 kilometers per hour). Cruising speed 230 miles per hour (370 kilometers per hour). Landing speed with flaps 65 miles per hour (105 kilometers per hour); without flaps 71 miles per hour (114 kilometers per hour). Service ceiling 29,000 feet (8850 meters). Climb per minute 2000 feet (610 meters). Cruising range 1050 miles (1690 kilometers).
**Construction.** Fuselage: chrome molybdenum steel tubing; removable fabric covered side panels; semi-monocque bottom, aluminum alloy; top panels aluminum alloy, removable. Wing: full cantilever; all-metal, aluminum alloy; ailerons aluminum alloy construction, fabric covered. Split trailing edge type flaps, manually operated. Tail group: stabilizer and fin all-metal; rudder and elevators, metal construction, fabric covered; trim tabs on elevators. Retractable landing gear, manually operated. Swivelling tail wheel.
**Standard equipment.** Hamilton Standard propeller, General tires, Hayes wheels, Bendix brakes, Cleveland oleo shock absorbers, Exide battery, Fafnir bearings, Pyle-National navigation lights, S & M landing lights, L-O-F shatterproof windshield, Pyralin cabin enclosure, Eclipse starter, flares, Pyrene fire extinguisher, radio bonding and shielding.
**Instruments.** Kollsman altimeter; Pioneer manifold pressure gauge, engine gauge unit, tachometer, airspeed, and turn and bank indicators, compass; Weston ammeter; flap position indicator; float type fuel gauge.




## PITCAIRN YG-2 and XOP-1 — 2-place — OBSERVATION

Models YG-2 and XOP-1; data given in that order. YG-2 is constructed for U. S. Army Air Corps, the other model for the U. S. Navy.
**Specifications.** Span of rotor 50′ (15.2 m.). Length 31′ 5″ (9.6 m.). Height 11′ 1″ (3.4 m.). Disc area 1960 ft.² (182.1 m.²). Blade area 112.56 ft.² (10.5 m.²). Power loading 7.62 lbs./h.p. (3.5 kg./h.p.). Rotor loading 1.63 lbs./ft.² (8 kg./m.²). Weight empty 2453 lbs. (1112.7 kg.). 2352 lbs. (1066.9 kg.). Useful load 747 lbs. (338.8 kg.); 948 lbs. (430 kg.). Gross weight 3200 lbs. (1451.5 kg.); 3300 lbs. (1496.9 kg.). Fuel 66 gals. (249.8 lit.). 8 gals. (30.3 lit.).
**Engine.** Wright Whirlwind R-975E, 420 h.p. at 2150 r.p.m.
**Performance.** Maximum speed 150 m.p.h. (241.4 k.p.h.). Cruising speed 125 m.p.h. (201.2 k.p.h.) Landing speed nil. Service ceiling 13,200 ft. (4023.4 m.); 13,700 ft. (4175.8 m.). Climb in 10 min. 8400 ft. (2560.3 m.); 8700 ft. (2651.8 m.). Cruising range 379 mi. (610 km.).
**Construction.** Fuselage: welded chrome molybdenum steel tubing; fabric covered; tandem seating arrangement, dual controls. Wingless type. Blades: fabric covered; spars 4130-X single tapered steel spars; ribs plywood routed type, closely spaced. Tail group: fin, rudder and stabilizer but no elevators; control in roll and pitch is accomplished through tilting of the rotor blades. Landing gear fixed type with cantilever supports on Army model; tripod type on Navy model. Provision made for folding blades.
**Standard equipment.** Material not released by U. S. Army Air Corps or Navy Department; in general, all as specified or furnished.
**Instruments.** A complete complement of flight, engine and rotor instruments is installed, with duplicate flight instruments forward. Illustrations accompanying this description show a photograph of the YG-2 as built for the U. S. Army Air Corps, and a diagram of the XOP-1 as built for the Navy.
*Other data on wingless autogiros in December, 1934,* AERO DIGEST.




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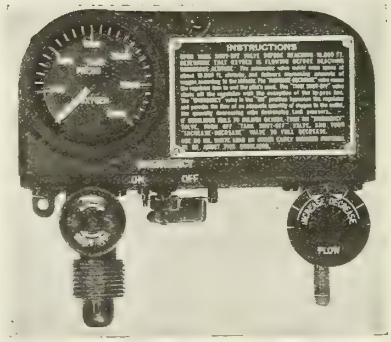
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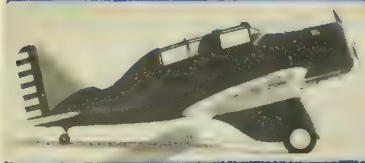
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## SEVERSKY 2-place GENERAL PURPOSE, FIGHTER

Models SEV X-BT and SEV-2P; data given in that order.
**Specifications.** Span 36′ (11 m.); alternate on X-BT only 41′ (12.5 m.). Length 25′3.5″ (7.7 m.). Height 9′5.62″ (2.9 m.). Wing area 220 ft.² (20.45 m.²); alternate on X-BT only 250 ft.² (23.2 m.²). Power loading 9.4 lbs./h.p. (4.3 kg./h.p.); 7.45 lbs./h.p. (3.9 kg./h.p.). Wing loading 21.3 lbs./ft.² (104 kg./m.²); 25.2 lbs./ft.² (123 kg./m.²). Weight empty 3250 lbs. (1475 kg.); 3550 lbs. (1610 kg.). Useful load 1440 lbs. (655 kg.); 2000 lbs. (910 kg.). Gross weight 4690 lbs. (2130 kg.); 5550 lbs. (2520 kg.). Fuel 160-200 gals. (606-757.1 lit.); Oil 10.5 gals. (39.8 lit.); 12.5 gals. (47.3 lit.).
**Engine.** P & W Wasp S2H1, 500 h.p. at 2200 r.p.m. at 10,500 ft. (3200 m.); Wright Cyclone GR1820G-7, 745 h.p. at 2100 r.p.m. at 15,000 ft. (4572 m.).
**Performance.** Maximum speed 260 m.p.h. (418 k.p.h.); 310 m.p.h. (500 k.p.h.). Cruising speed 224 m.p.h. (361 k.p.h.); 280 m.p.h. (451 k.p.h.). Landing speed with flaps 65 m.p.h. (105 k.p.h.); 67 m.p.h. (108 k.p.h.). Service ceiling 26,300 ft. (8000 m.); 31,600 ft. (9630 m.). Climb per min. 1350 ft. (412 m.); 2350 ft. (717 m.). Cruising range 950 mi. (1530 km.); 1100 mi. (1770 km.).
**Construction.** Fuselage: all-metal stressed skin semi-monocoque; Wing: all-metal, full cantilever; stressed skin; 17S-T and 24S-T. Flaps all-metal 24S-T Alclad. Tail group: all-metal stressed skin; full cantilever; 24S-T. Retractable landing gear.
**Standard equipment.** Hamilton Standard constant speed propeller, General tires, Bendix brakes, Cleveland shock absorbers, Exide battery, Fafnir control bearings, Consolidated navigation lights; Adams & Westlake landing lights, Eclipse starter.
**Instruments.** Ashcroft engine gauge unit; Weston carburetor temperature gauge, voltmeter-ammeter; Lewis thermocouple, Liquidometer fuel gauge; Breeze fuel-air mixture analyzer; Sperry directional gyro; flap and wheel position indicators; and flight and engine instruments, Kollsman and Pioneer.

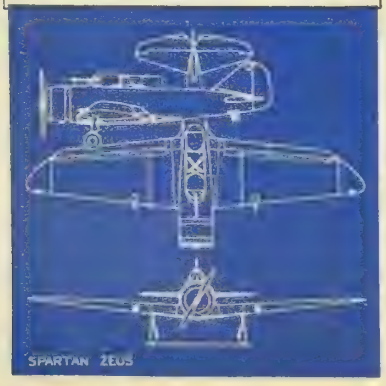





## SEVERSKY SEV-BT-8 2-place BASIC TRAINER

**Specifications.** Span 36′ (11 m.); alternate 41′ (12.5 m.). Length 24′5.5″ (7.45 m.). Height 8′10″ (2.69 m.). Wing area 220 ft.² (20.45 m.²); alternate 250 ft.² (23.2 m.²). Power loading 10.1 lbs./h.p. (4.6 kg./h.p.). Wing loading 18.4 lbs./ft.² (90 kg./m.²). Weight empty 2950 lbs. (1340 kg.). Useful load 1100 lbs. (500 kg.). Gross weight 4050 lbs. (1840 kg.). Fuel 105 gals. (398 lit.). (fuel load optional; standard design accommodates 160 or 200 gals.).
**Engine.** P & W Wasp Junior R-985; 400 h.p. at 2200 r.p.m.
**Performance.** Maximum speed 176 m.p.h. (284 k.p.h.). Cruising speed 154 m.p.h. (248 k.p.h.) at 275 h.p. at 1900 r.p.m. Landing speed with flaps 61.5 m.p.h. (99 k.p.h.). Service ceiling 17,000 ft. (5180 m.). Climb per min. 1150 ft. (350 m.). Cruising range 725 mi. (1170 km.).
**Construction.** Fuselage: all-metal, stressed skin monocoque type; circular section structure consisting of continuous longitudinal stringers formed from flat Aluminum alloy sheet stock and vertical bulkheads or former rings of 24S-T Alclad. Wing: all-metal, full cantilever, stressed skin construction; 17S-T and 24S-T Alclad and steel where necessary. Flap all-metal; reinforced flat sheet 24S-T Alclad. Tail group: all-metal, stressed skin.
**Standard equipment.** Hamilton Standard controllable pitch propeller, General tires, Automatic Fan wheels, Bendix hydraulic brakes, Cleveland shock absorbers, Exide battery, Fafnir control bearings, Consolidated navigation lights, Adams & Westlake landing lights, Pyrene fire extinguisher, Wiley flares, Pittsburgh safety glass windshield, Plexiglas cabin enclosure, Eclipse starter.
**Instruments.** Pioneer altimeter, manifold pressure gauge, clock, tachometer, airspeed, turn and bank and rate of climb indicators, compass; Kollsman sensitive altimeter, suction gauge; Lewis thermocouple; Weston ammeter-voltmeter, carburetor temperature gauge; Sperry directional gyro; Ashcroft engine gauge unit; Liquidometer fuel gauge; flap position indicator.

PHOTOGRAPH NOT AVAILABLE




## SPARTAN Zeus 2-place ATTACK-BOMBER, TRAINER

Models 8W & 9W; data given in that order.
**Specifications.** Span 39′ (11.9 m.). Length 26′ 6″ (8.8 m.). Height 9′ 3″ (2.8 m.). Wing area 250 ft.² (23.2 m.²). Power loading 8.58 lbs./h.p. (4 kg./h.p.); 9.75 lbs./h.p. (4.59 kg./h.p.). Wing loading 18 lbs./ft.² (9.05 kg./m.²); 15.60 lbs./ft.² (7.63 kg./m.²). Weight empty 3050 lbs. (1383 kg.); 2650 lbs. (1203 kg.). Useful load 1070 lbs. (485 kg.); 1050 lbs. (476 kg.). Payload 380 lbs. (172.5 kg.); 200 lbs. (90.8 kg.). Gross weight 4500 lbs. (2100 kg.); 3900 lbs. (1770 kg.). Fuel 100 gals. (416.5 lit.). Oil 8 gals. (30.3 lit.).
**Engine.** P & W Wasp Jr. SC-G, 525 h.p. at 2600 r.p.m. at 8000 ft. (2438.4 m.); P & W Wasp Jr. SB, 450 h.p. at 2300 r.p.m. at 5000 ft. (1524 m.).
**Performance.** Maximum speed 225 m.p.h. (362 k.p.h.); 190 m.p.h. (306 k.p.h.). Cruising speed 210 m.p.h. (338 k.p.h.); 180 m.p.h (290 k.p.h.). Landing speed with flaps 64 m.p.h. (103 k.p.h.); 62 m.p.h. (100 k.p.h.). Service ceiling 23,000 ft. (7020 m.); 20,000 ft. (6080 m.). Climb per min. 1650 ft. (503 m.); 1300 ft. (397 m.). Cruising range 680 mi. (1095 km.).
**Construction.** Fuselage: steel tube construction from engine mount to wing rear chord member; semi-monocoque construction aft of this point; 24S-T Alclad covered. Wing: monospar construction; welded steel tube spar; 4130 steel tubing, heat treated; truss type 24S-T Alclad ribs riveted to spar; covering and stiffeners 24S-T. Flaps aileron type, metal covered. Tail group: semi-monocoque fin and stabilizer, 24S-T; rudder and elevators, steel tube spars, Alclad ribs.
**Standard equipment.** Hamilton Standard controllable-pitch propeller, General tires, Hayes Autofan wheels, Bendix brakes, Cleveland shock absorbers, Reading battery, Fafnir control bearings, Grimes landing and navigation lights, Plexiglas windshield and cabin enclosure, Eclipse starter.
**Instruments.** Complete installation of flight and engine instruments of Pioneer, Weston, AC, U.S., and Sperry manufacture.

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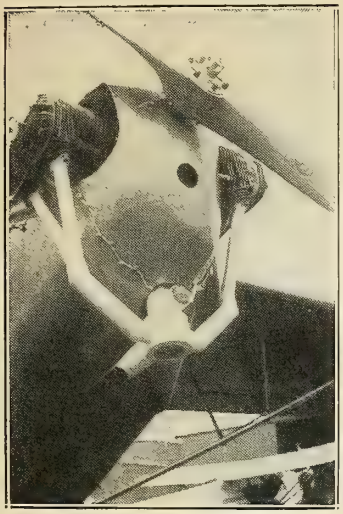
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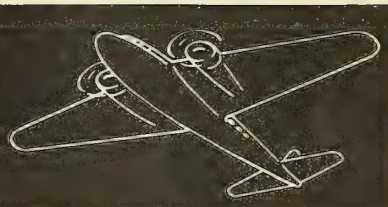
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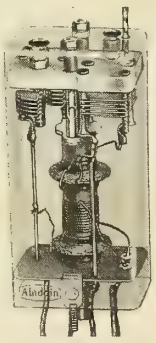
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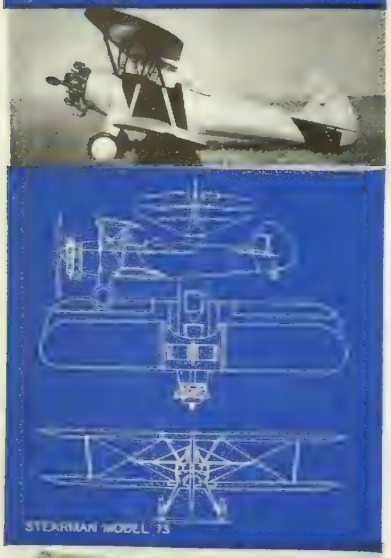


## STEARMAN Model 75 — 2-place — PRIMARY TRAINER



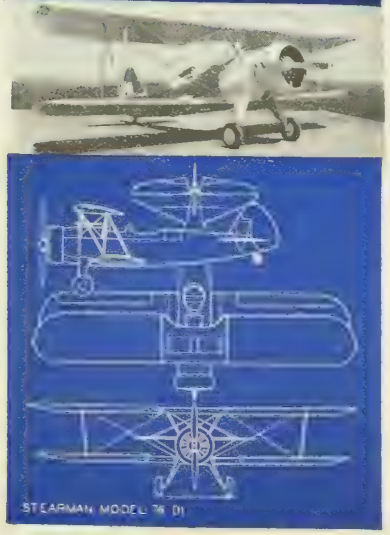
**Specifications.** Span 32′2″ (9.8 m.). Length 25′.41″ (7.6 m.). Height 9′5″ (2.9 m.). Wing area 297.6 ft.² (27.6 m.²). Power loading 12.04 lbs./h.p. (5.46 kg./h.p.). Wing loading 8.7 lbs./ft.² (42.5 kg./m.²). Weight empty 1880 lbs. (852.8 kg.). Useful load 709 lbs. (321.6 kg.). Gross weight 2589 lbs. (1174.4 kg.). Baggage 60 lbs. (27.2 kg.). Fuel 47 gals. (177.9 lit.). Oil 4.4 gals. (16.7 lit.).
**Engine.** Lycoming R-680-5, 215 h.p. at 2100 r.p.m.
**Performance.** Maximum speed 125 m.p.h. (201 k.p.h.). Cruising speed 103 m.p.h. (166 k.p.h.) at 75% power. Landing speed 52 m.p.h. (84 k.p.h.). Service ceiling 14,000 ft. (4267 m.). Climb per min. 720 ft. (219 m.). Cruising range 412 mi. (663 km.).
**Construction.** Fuselage: conventional welded chrome molybdenum steel tubing construction; detachable engine mount; drawn aluminum alloy fairing; fabric covered; tandem seating arrangement; dual controls, parachute type adjustable seats. Wings: wood construction, solid spruce beams, spruce truss type ribs; fabric covered; aluminum alloy compression members, AN standard drag wires, sheet aluminum alloy leading edge formers; fittings of aluminum alloy with steel insert bushings; ailerons aluminum alloy construction, ball bearing hinges; struts streamline section chrome aluminum alloy tubing. Tail group: welded chrome molybdenum steel tubing; sheet aluminum alloy leading edge former; wire braced structure; fabric covered, except all-metal trimming tab on elevator. Full cantilever landing gear; splined torque resisting; oil-spring shock absorbers; metal fairing. Tail wheel full swivelling, steerable; air-oil shock absorber.
**Standard equipment.** Metal propeller, hand inertia starter, streamline tires and wheels, hydraulic brakes, parking brake, hydraulic shock absorbers, fire extinguisher, shock pad, map case, waterproof engine and cockpit covers.
**Instruments.** Altimeter, clock, tachometer, airspeed indicator, compass, visual fuel gauge.

## STEARMAN Model 73 — 2-place — PRIMARY TRAINER




Models 73 and 73L3; data given in that order.
**Specifications.** Span 32′2″ (9.8 m.). Length 25′1.4″ (7.7 m.); 25′.25″ (7.6 m.). Height 9′6.1″ (3 m.); 9′1.88″ (2.8 m.). Wing area 297.6 ft.² (27.6 m.²); 297.4 ft.² (27.58 m.²). Power loading 12.33 lbs./h.p. (5.6 kg./h.p.); 11.67 lbs./h.p. (5.29 kg./h.p.). Wing loading 9.12 lbs./ft.² (44.5 kg./m.²); 8.83 lbs./ft.² (43.11 kg./m.²). Weight empty 2020 lbs. (916.3 kg.); 1938 lbs. (879 kg.). Useful load 693 lbs. (314.3 kg.); 688 lbs. (312.1 kg.). Gross weight 2713 lbs. (1230.6 kg.); 2626 lbs. (1191 kg.). Baggage 60 lbs. (27.2 kg.). Fuel 43 gals. (162.8 lit.). Oil 4 gals. (15.1 lit.).
**Engine.** Wright Whirlwind R790-A, 220 h.p. at 2000 r.p.m.; Lycoming R-680-C1, 225 h.p. at 2100 r.p.m. Model 73L3 also available with Wright R-760-ET (Model 73B1); Wright R-760E (Model 73B2); Jacobs L4M (Model 73J1).
**Performance.** Maximum speed 118 m.p.h. (190 k.p.h.); 123 m.p.h. (198 k.p.h.). Cruising speed 103 m.p.h. (166 k.p.h.) at 75% power; 105 m.p.h. (169 k.p.h.). Landing speed 51 m.p.h. (82.1 k.p.h.). Service ceiling 12,200 ft. (3719 m.); 13,500 ft. (4115 m.). Climb per min. 820 ft. (250 m.). Cruising range 464 mi. (747 km.); 320 mi. (515 km.).
**Construction.** Fuselage: Conventional welded chrome moly steel tubing; detachable engine mount; drawn aluminum alloy fairing; fabric covered; tandem seating arrangement; dual controls. Wings: wood construction; solid spruce beams; spruce truss type ribs; fabric covered; aluminum alloy compression members; AN standard drag wires; sheet aluminum alloy leading edge formers; ailerons aluminum alloy construction ball bearsteel tubing.
**Standard equipment.** Metal propeller; Hamilton Standard propeller; hand inertia starter, mechanical brakes; oleo shock absorbers; crash pad, fire extinguisher.
**Instruments.** Altimeter, engine gauge unit, tachometer, airspeed indicator, compass, turn and bank indicator, clock, fuel gauge.

## STEARMAN Model 76D1 — 2-place — ADVANCED TRAINER




**Specifications.** Span 32′ 2″ (9.8 m.). Length 24′ 1.06″ (7.34 m.). Height 9′ 1.9″ (2.8 m.). Wing area 297.6 ft.² (27.6 m.²). Power loading 10.43 lbs./h.p. (4.73 kg./h.p.). Wing loading 11.21 lbs./ft.² (54.74 kg./m.²). Weight empty 2110 lbs. (957.1 kg.). Useful load 1226 lbs. (556.1 kg.). Gross weight 3336 lbs. (1513.2 kg.). Baggage 60 lbs. (27.2 kg.). Fuel 70 gals. (265 lit.). Oil 5 gallons (18.9 liters).
**Engine.** P & W Wasp Junior T1B, 320 h.p. at 2000 r.p.m.; also available with the Wright R-975-E (Model 76C1); Wright R-975E-3 (Model 76C3); Wasp Junior TB (Model 76D2); Wasp Junior SB (76D3).
**Performance.** Maximum speed 153 m.p.h. (246 k.p.h.). Cruising speed 135 m.p.h. (217 k.p.h.) at 75% power; Landing speed 56 m.p.h. (90 k.p.h.). Service ceiling 16,700 ft. (5090 m.). Climb per min. 1000 ft. (305 m.). Cruising range 472 mi. (760 km.).
**Construction.** Fuselage: welded chrome moly steel tubing; detachable engine mount; drawn aluminum alloy fairing; fabric covered; tandem seating arrangement; dual controls; parachute type adjustable seats. Wings: wood construction; solid spruce beams, spruce truss type ribs; fabric covered; aluminum alloy compression members; AN standard drag wires; sheet aluminum alloy leading edge formers; fittings of aluminum alloy with steel insert bushings; ailerons aluminum alloy construction, ball bearing hinges; struts streamline section chrome molybdenum steel tubing. Tail group: welded chrome molybdenum steel tubing; fabric covered. Full cantilever landing gear, splined torque resisting, metal fairing.
**Standard equipment.** Hamilton Standard propeller, hand inertia starter, streamline tires, mechanical brakes, spring-oil shock absorbers, navigation lights, fire extinguisher, map case, baggage compartment, waterproofed cockpit and engine covers, crash pads, and dual controls.
**Instruments.** Altimeter, oil pressure and oil temperature gauges, tachometer, airspeed indicator, compass; visual type fuel gauge.

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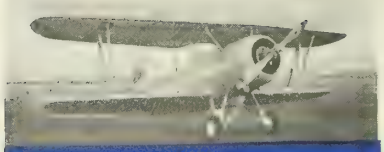
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## VOUGHT V-142 — 2-place — SCOUT-BOMBER



**Specifications.** Span 33′ 3″ (10.15 m.). Length 27′ 9.37″ (8.48 m.). Height 10′ (3.05 m.). Wing area 327 ft.² (30.4 m.²). Power loading 7.8 lbs./h.p. (3.5 kg./c.v.). Wing loading 16.7 lbs./ft.² (81.8 kg./m.²). Weight empty 3550 lbs. (1612.5 kg.). Useful load 1895 lbs. (860.5 kg.). Gross weight 5445 lbs. (2473 kg.). Fuel 145 gals. (549 lit.). Oil 12 gals. (49 lit.).
**Engine.** Pratt & Whitney Twin Wasp Junior, 700 h.p. at 2500 r.p.m. at 8500 ft. (2590.8 m.).
**Performance.** Maximum speed 205 m.p.h. (330 k.p.h.). Cruising speed 172 m.p.h. (286 k.p.h.). Landing speed with flaps 65 m.p.h. (105 kp.h.). Service ceiling 24,200 ft. (7370 m.). Climb per min. 1330 ft. (405 m.). Cruising range 687 mi. (1106 km.).
**Construction.** Fuselage: metal structure of chrome molybdenum steel tubing; metal cowling forward of cockpits; fabric covering aft attached to aluminum alloy fairings; engine mount of chrome molybdenum; convenient access doors for inspection and maintenance; tandem seating arrangement, dual controls; sliding transparent canopy top. Wings: metal structure, fabric covered; spars built-up I section of aluminum alloy; ribs rolled aluminum alloy section riveted to spars; struts aluminum alloy tubing. N-type; upper wing attached to fuselage by streamlined struts and wires. Split type trailing edge flaps, manually operated. Tail group: full cantilever; metal structure, fabric covered rudder and elevators; stabilizer and fin metal covered; trimming tabs on elevators and rudder. Fixed split axle type landing gear with long stroke oleo spring shock absorber struts. Fully swivelling tail wheel.
**Standard equipment.** Hamilton Standard controllable pitch propeller, streamline wheels, battery, navigation and landing lights.
**Instruments.** Altimeter (2), manifold pressure gauge, clock (2), engine gauge unit consisting of fuel pressure, oil pressure and oil temperature gauges, fuel gauge, tachometer, voltmeter-ammeter, airspeed indicator (2), turn and bank indicator, compass (2) carburetor temperature gauge.



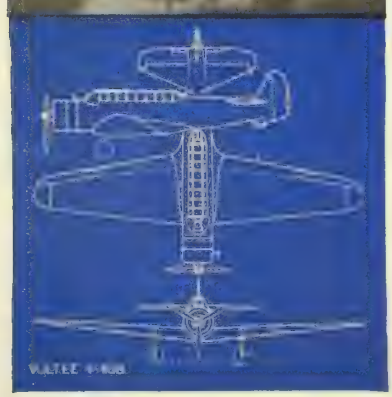
## VOUGHT V-143 — 1-place — FIGHTER



**Specifications.** Span 33′ 6″ (10.4 m.). Length 22′ 2″ (6.7 m.). Height 9′ (2.74 m.). Wing area 187 ft.² (17.4 m.²). Power loading 6.15 lbs./h.p. (2.75 kg./c.v.). Wing loading 23 lbs./ft.² (112.5 kg./m.²). Gross weight 4300 lbs. (1950 kg.). Fuel 112 gals. (424 lit.). Oil 10 gals. (38 lit.).
**Engine.** Pratt & Whitney Twin Wasp Jr., 700 h.p. at 2500 r.p.m. at 8900 ft. (2712.7 m.).
**Performance.** Maximum speed 280 m.p.h. (450 k.p.h.). Cruising speed 225 m.p.h. (362 k.p.h.). Landing speed with flaps 65 m.p.h. (105 kp.h.). Service ceiling 30,000 ft. (9150 m.). Climb per min. 2700 ft. (824 m.). Cruising range 870 mi. (1400 km.).
**Construction.** Fuselage: semi-monocoque, aluminum alloy structure; stressed skin, welded tubular steel engine mount; pilot located as far forward as possible with transparent sliding enclosure affording protection from wind and weather. Wing: monocoque, full cantilever; all-metal; consists of center section and two outer panels; ailerons fabric covered, aerodynamically and dynamically balanced. Flaps in trailing edge of wing, hydraulically operated. Tail group: full cantilever; fixed surfaces all-metal; elevators and rudder, metal structure, fabric covered, aerodynamically and dynamically balanced and provided with trim tabs. Full cantilever landing gear of single oleo strut type, fully retractable, hydraulically operated. Tail wheel fully swivelling and provided with locking means operated from the cockpit.
**Standard equipment.** Hamilton Standard controllable pitch propeller, 9′ 6″ diameter, streamline tires, hydraulic brakes, battery, navigation lights, cowl flaps for controlling engine cooling, parking brake, provision made for bomb racks, camera gun, radio and oxygen apparatus.
**Instruments.** Altimeter, manifold pressure gauge, clock, fuel gauges (2), fuel pressure, oil pressure and oil temperature gauge unit, tachometer, airspeed indicator, turn and bank indicator, rate of climb indicator, compass, wheel and flap position indicators.
*Other data in Oct., 1936* AERO DIGEST.



## VULTEE V-11GB — 3-place — ATTACK-BOMBER



Attack and bomber models; data given in that order.
**Specifications.** Span 50′ (15.2 m.). Length 37′ 10″ (11.5 m.). Height 10′ (3.05 m.) Wing area 384 ft.² (35.7 m.²). Power loading (lbs./h.p.) 10.4; 13.1: (kg./h.p.) 4.71; 5.95. Wing loading (lbs./ft.²) 23; 29: (kg./m.²) 112.2; 144.5. Weight empty 5977 lbs. (2710 kg.). Useful load (lbs.) 2876; 5173: (kg.) 1303; 2345. Gross weight (lbs.) 8853; 11,150: (kg.) 4013; 5055. Fuel (gals.) 150; 440: (lit.) 568; 1667. Oil (gals.) 15; 26: (lit.). 43.3; 98.5.
**Engine.** Wright Cyclone GR-1820G-2, 850 h.p. at 2100 r.p.m. at 5800 ft. (1767.8 m.).
**Performance.** Maximum speed (m.p.h.) 236; 225: (k.p.h.) 380; 362 at 5800 ft. Cruising speed (m.p.h.) 218; 203: (k.p.h.) 349; 326. Landing speed with flaps (m.p.h.) 65.5; 73.4: (k.p.h.) 105; 118. Service ceiling (ft.) 24,500; 19,000: (m.) 7480; 5800. Climb per min. (ft.) 1335; 950: (m.) 407.5; 290. Cruising range (mi.) 975-2800; 2370: (km.) 1568-4500; 3815.
**Construction.** Fuselage: all-metal, 24S-T; semi-monocoque; sliding section canopy top enclosure. Wing: all-metal, 24S-T, stressed skin; full cantilever in three sections. Split trailing edge type flaps, all-metal, manually or electrically operated; attached to wing by continuous hinges. Tail group: all-metal 24S-T, stressed skin; full cantilever.
**Standard equipment.** Hamilton Standard propeller, Eclipse starter, Goodyear tires, wheels and brakes, oleo shock absorbers, Exide battery, Fafnir ball bearings for engine and plane controls, Grimes navigation lights, S & M landing lights, Pyrene fire extinguisher, Wiley flares, first aid equipment.
**Instruments.** Kollsman sensitive altimeter, manifold pressure, engine unit gauges, tachometer, airspeed and rate of climb indicators, compass; Pioneer turn and bank indicator; Weston ammeter, air temperature and carburetor temperature gauges, thermocouple; Sperry directional gyro, gyro-horizon; MotoMeter fuel gauge, wheel and flap position indicators; Waltham clock.



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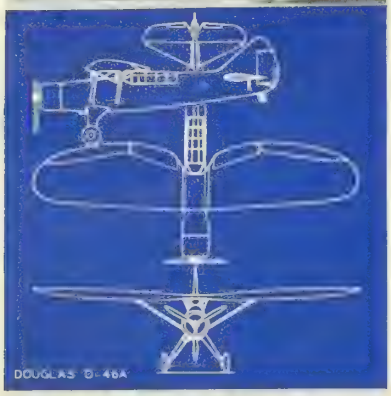
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# NEWEST TYPES OF MILITARY AIRCRAFT

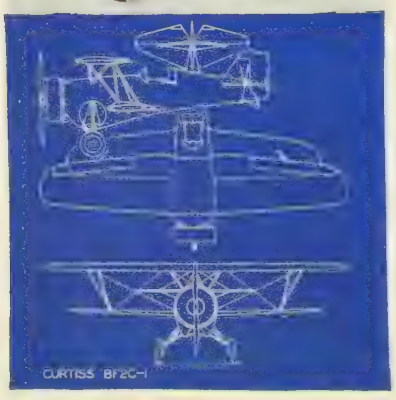
The types of aircraft illustrated on this page are among those upon which performance and construction data are not yet released by the War or Navy Departments. Military restrictions prohibit publication of plan views of certain experimental and service types which, therefore, are omitted from the accompanying presentation. The overall dimensions of the types illustrated are:

| TYPE | SPAN | LENGTH |
|---|---|---|
| Douglas O-46A Observation.... | 45′ 9″ | 40′ 0″ |
| N. American O-47 Observ..... | 46′ 4″ | 33′ 3″ |
| Curtiss BF2C-1 Dive-Bomber.. | 31′ 6″ | 23′ 6″ |
| Curtiss SOC-1 Scout-Observ... | 36′ 0″ | 26′ 6″ |
| Consol. PBY-1 Patrol Bomb... | 104′ 0″ | 26′ 6″ |
| Curtiss P-36 Pursuit..... | 37′ 4″ | 28′ 1″ |
| Curtiss A-18 Attack..... | 59′ 6″ | 40′ 6″ |
| Curtiss SBC-3 Scout-Bomber.... | 34′ 0″ | 27′ 10″ |



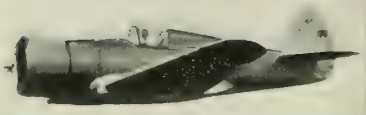






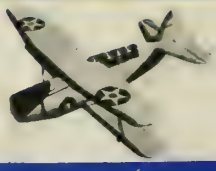















# 1937 Model Y

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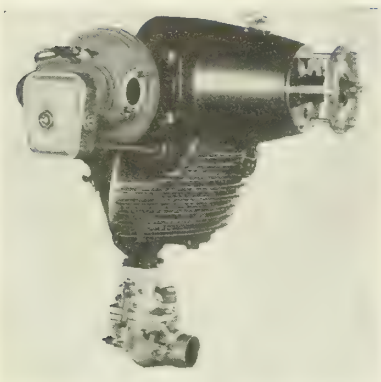
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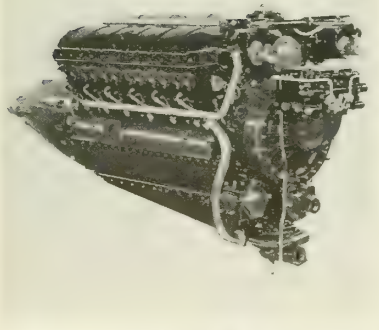
# Aircraft Engines

**Data on and illustrations of 41 basic types of American aircraft engines are presented in the following pages. These engines (except where otherwise noted) have ATCs granted or pending, are in current production and available for private, commercial or military aircraft, both in this country and abroad. They represent a horsepower range from 40 to 1200.**



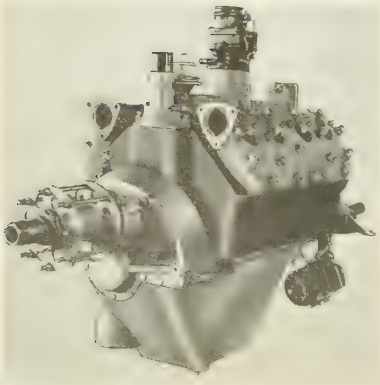
## AERONCA E-113C — 2-cylinder-horizontal opposed — ATC 71

**Specifications.** Direct-drive, air-cooled. Manufacturer's rating 40 h.p. at 2500 r.p.m.; Department of Commerce rating 36 h.p. at 2400 r.p.m. 36 h.p. available for take-off. Compression ratio 5.4:1. Bore 4.25″; stroke 4″; displacement 113.5 cu. in. Length 24.125″; height 26″; width 34.5″. Weight (with propeller hub, magneto, carburetor, automatic spark control) 121 lbs. Weight per h.p. 3.02 lbs. Fuel consumption .55 lb./b.h.p./hr. Oil consumption .25 pt./hr. Octane fuel rating 73.
**Construction.** Crankcase heat-treated and machined Bohnalite aluminum alloy. Crankshaft Wyman-Gordon forging, completely machined. Cylinders of steel forgings machined. Cylinder heads heat-treated and machined aluminum alloy. Permite aluminum alloy pistons fabricated in a permanent mold. Connecting rods of Wyman-Gordon forgings, machined. Ball bearings on camshaft and rocker arms, ball thrust bearing on crankshaft with roller main bearings adjacent to throws, Federal-Mogul cadmium-silver-copper steel-backed bearing shells in connecting rod. SAE tachometer drive and special magneto drive provided. Force feed lubrication to connecting rod bearings, splash to balance of engine. Tulip head type solid intake and exhaust valves. Pedrick and American Hammered piston rings, 2 compression, 1 oil.
**Accessories.** Bosch FF2AR magneto with C-123 impulse, Bendix-Stromberg NAS-2 carburetor, Champion or BG spark plugs.



## ALLISON V-1760-C6 — 12-cylinders — *ATC

*ATC pending.
**Specifications.** Geared, liquid-cooled. Normal and take-off rating (manufacturer's) 1000 horsepower at 2600 revolutions per minute. Compression ratio 6:1; blower gear ratio 6.75:1; propeller shaft ratio 2:1. Bore 5.5 inches; stroke 6 inches; displacement 1710 cubic inches. Length 94.47 inches; width 28.94 inches; height 40.72 inches. Weight (with magneto, carburetor, propeller hub cones and nut, coolant pump and pipes, exhaust stack flanges, provision for hydro controllable-pitch propeller and governor, and the following drives: tachometer, fuel pump, vacuum pump and generator) 1280 pounds. Weight in pounds per horsepower 1.28. Fuel consumption at rated horsepower .60 pound per brake horsepower per hour. Oil consumption at rated h.p. .025 lb./b.h.p./hr. Fuel octane rating 87.
**Construction.** Crankshaft, chrome nickel molybdenum steel forging. Crankcase, aluminum alloy casting. Cylinder assemblies are cast aluminum heads with steel sleeves; cylinders are arranged in-line, Vee-type with two banks of six cylinders each. Piston pins are alloy steel, of the full floating type; there are two compression and three oil piston rings to each cylinder. Connecting rods, chrome nickel molybdenum steel forgings.
**Accessories.** Scintilla double magneto and distributors, Stromberg carburetor, finned BG radio shielded spark plugs, Wilcox Rich intake and exhaust valves, radio shielding.



## ARROW F — 8-cylinder—Vee — ATC 161

**Specifications.** Geared, liquid-cooled. Manufacturer's rating 82 h.p. at 3075 r.p.m. Compression ratio 6.3:1; propeller shaft ratio 1.95:1. Bore 3.06″; stroke 3.75″; displacement 221 cu. in. Length 41.5″; height 33″; width 20.5″. Weight (with starter) 398 lbs. Weight in lbs./h.p. at sea level 4.85. Fuel consumption at rated r.p.m. .51 lb./b.h.p./hr. Oil consumption at rated r.p.m. .005 lb./bh.p./hr.
**Construction.** Converted Model V-8 Ford automobile engine. Crankcase cast alloy iron. Crankshaft cast alloy steel; counterweight integral. Block one-piece cast iron. Propeller shaft hollow, tapered, alloy steel. Connecting rods steel forging, I section. Crankpin bearings copper-lead; propeller shaft bearings Timken roller. Camshaft cast alloy iron. Pistons aluminum alloy, full skirt with two compression and two oil rings to each cylinder. Valves chrome nickel alloy steel, single, L-head. Valve seat inserts on exhaust valves only. Valve mechanism direct cam and spring. Pressure lubrication to main bearings, connecting rod and camshaft bearings. Gear type oil pump; impeller type, aluminum alloy water pump.
**Accessories.** Electric Autolite 6 volt dc generator, AC Spark Plug diaphragm fuel pump, Stromberg dual down draft carburetor, Ford automatic control distributor, Champion No. 13 spark plugs, Arrow impeller type water pump and Arrow hand-operated starter.

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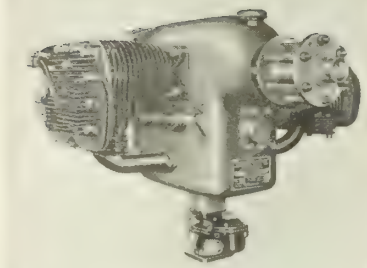
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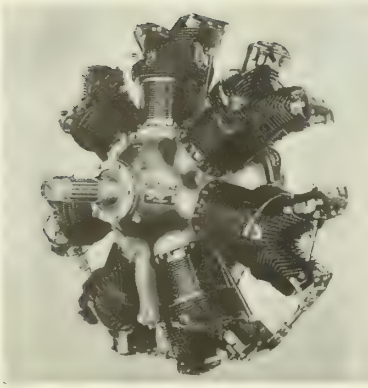
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## CONTINENTAL A-40-4 — 4-cylinder—horizontal opposed — ATC 72



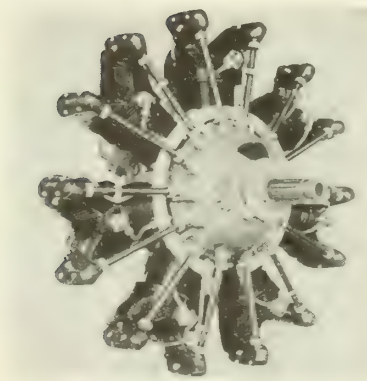
**Specifications.** Direct drive, air-cooled. Manufacturer's and Dept. of Commerce rating 40 h.p. at 2575 r.p.m. Cruising r.p.m. 2250. Compression ratio 5.2:1. Bore 3.125″; stroke 3.75″; displacement 115 cu. in. Length 27.31″; height 19.44″; width 26.44″. Weight (with magneto and carburetor) 143 lbs. Weight per h.p. 3.7 lbs. Fuel consumption .70 lb./b.h.p./-hr. Oil consumption .025 lb./b.h.p./hr. Also available with dual ignition (Model A-40-5); weight 156 lbs.
**Construction.** Crankcase one piece cast heat treated aluminum alloy, heavily ribbed within for strength. Crankshaft three throw, one piece finished all over heat-treated steel forging. Cylinders L head, cast iron, cast in pairs and attached to crankcase by six studs and nuts for each unit. Cylinder heads heat-treated aluminum alloy cast in pairs, bolted to cylinder barrels by nickel alloy steel studs and nuts. Full skirt pistons permanent mold, heat-treated aluminum alloy. Connecting rods heat-treated steel forging with split big end; replaceable. Plain bearings. Magneto and tachometer drive at rear of pressure oil pump. Wet sump lubrication, pressure feed to main and connecting rod bearings and camshaft bearings. Mushroom type intake and exhaust valves, one for each cylinder. Piston rings, 3 compression, 1 oil for each cylinder. SAE No. 0 propeller shaft.
**Accessories.** Single barrel Stromberg NA-S2, Bosch FF4 or Scintilla SF4L magneto, B. G. or Champion spark plugs.

## CONTINENTAL W670 — 7-cylinder—radial — ATCs 162-168



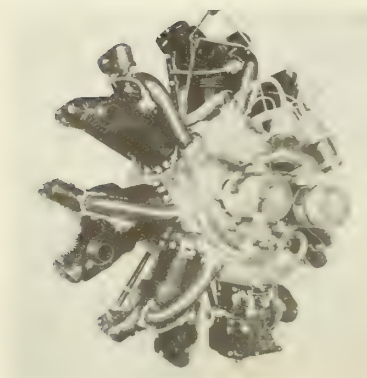
Models Series K and M; and Series K-1 and M-1; data given in that order. K-1 and M-1 engines are manifold fuel injection types.
**Specifications.** Direct drive; air-cooled. Maximum rating 225 h.p. at 2175 r.p.m.; 240 h.p. at 2200 r.p.m.; 230 h.p. at 2200 r.p.m.; 250 h.p. at 2200 r.p.m. Compression ratio 5.4:1; 6.1:1; 5.4:1; 6.1:1. Bore 5.125″; stroke 4.625″ displacement 668 cu. in. Length 30.125″ from center of propeller, height 42.25″; diameter 42.25″. Weight (with carburetor and magnetos) 450 lbs.; (with fuel injector and magnetos) 460 lbs. Weight in lbs./h.p. at sea level 2. Fuel consumption at rated h.p. (max.) .54 lb./b.h.p./hr. Oil consumption at rated h.p. (max.) .020 lb./b.h.p./hr.
**Construction.** Crankcase heat-treated cast aluminum alloy, split on centerline of cylinders. Crankshaft, two-piece machined, heat-treated steel forging; SAE #20 shaft end. Heat-treated aluminum alloy cylinder heads (can be furnished with exhaust directed to rear or front) with heat treated forged steel cylinders, screwed and shrunk onto heads. Pistons, forged aluminum alloy with 3 compression and 1 oil ring to each cylinder. Heat treated steel forging and machined connecting rods; one-piece master rod; lead bronze master rod bearing. Dry sump lubrication with pressure feed to plain bearings and rocker arms; one pressure and two scavenge pumps.
**Accessories.** Scintilla magnetos (2), Stromberg carburetor or Marvel fuel injector, Eclipse starter and generator, BG spark plugs, Breeze shielding, Evans fuel pump.

## JACOBS L-4 — 7-cylinder—radial — ATC 121



**Specifications.** Direct drive; air-cooled; battery ignition. Also model L-4M, a magneto ignition type; engines otherwise identical. Department of Commerce and manufacturer's rating (maximum) 225 h.p. at 2000 r.p.m. Cruising rating 175 h.p. at 1900 r.p.m.; h.p. available for take-off 240 h.p. at 2100 r.p.m. at 27.5″ Hg. manifold pressure. Compression ratio 5.357:1. Bore 5.25″; stroke 5″; displacement 757 cu. in. Length 36.968″; diameter 43.5″. Weight (with generator and control box, carburetor, ignition wiring, spark plugs, propeller centering cones and nut, oil strainer) approximately 450 lbs. (460 lbs. for L-4M). Weight in lbs./h.p. 2. Fuel consumption at rated h.p. .5-.55 lb./b.h.p./hr. Oil consumption at rated h.p. .018 lb./b.h.p./hr. Fuel octane rating 73.
**Construction.** Crankcase magnesium and aluminum heat-treated alloy castings; two-piece main case. Crankshaft chrome nickel molybdenum steel forgings with four ball bearings. Cylinders chrome nickel molybdenum steel forgings with aluminum alloy cast cylinder heads screwed and shrunk onto barrels. Pistons forged aluminum with 1 one-piece compression, 1 two-piece compression and 2 two-piece oil piston rings to each cylinder. Pressure lubrication to master rod, knuckle pins, cam hub bearing, all gears; one pressure, one scavenging geared pump.
**Accessories.** Scintilla battery timers (2) magnetos (on L-4M). Stromberg carburetor, BG spark plugs, Thompson valves, generator (with battery ignition).

## JACOBS L-5 — 7-cylinder—radial — ATC 156



**Specifications.** Direct drive; air-cooled; battery ignition. Also model L5M, a magneto ignition type; engines otherwise identical. Department of Commerce and manufacturer's rating (maximum) 285 h.p. at 2000 r.p.m. Cruising rating 210 h.p. at 1900 r.p.m.; h.p. available for take-off 300 at 2125 r.p.m. at 27.5″ Hg. manifold pressure. Compression ratio 6:1. Bore 5.5″; stroke 5″; displacement 831 cu. in. Length 36.968″; diameter 43.5″. Weight (with generator and control box; battery timers; ignition coils, ignition wiring; spark plugs, carburetor, propeller hub centering cones and nut, oil strainer) approximately 485 lbs. (495 lbs. for L5M). Weight in lbs./h.p. 1.7. Fuel consumption at rated h.p. .53 lb./b.h.p./hr. Oil consumption at rated h.p. .018 lb./b.h.p./hr. Fuel octane rating 73.
**Construction.** Crankcase magnesium and aluminum heat-treated alloy castings; two-piece main case. Crankshaft, chrome nickel molybdenum steel forgings with two roller and two ball bearings. Cylinders chrome nickel molybdenum steel forgings with aluminum alloy cast cylinder heads, screwed and shrunk on. Pistons forged aluminum with 1 one-piece compression, 1 two-piece compression and 2 two-piece oil piston rings to each cylinder. Pressure lubrication to master rod, knuckle pins, cam hub bearing, all gears; one pressure, one scavenging geared pump.
**Accessories.** Scintilla battery timers (2), (magnetos on L-5M); Stromberg carburetor, BG spark plugs, Thompson valves, generator (with battery ignition).



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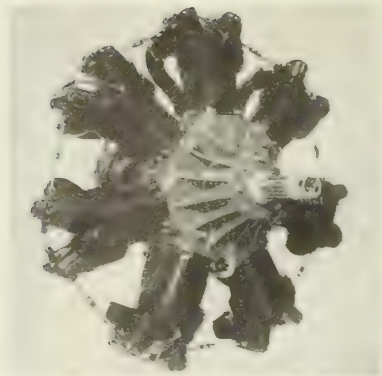
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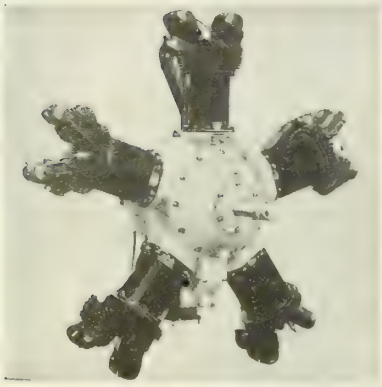
## KINNER SC-7 — 7-cylinder—radial — *ATC

*ATC pending.

**Specifications.** Direct drive, air-cooled. Manufacturer's rating 370 h.p. at 1900 r.p.m. at 5000 ft. Power available for take-off 400 at 1900 r.p.m. Compression ratio 5.5:1. Blower gear ratio 9.71:1 Bore 5.625″; stroke 6″; displacement 1044 cu.in. Length 45.41″; diameter 47.75″. Weight dry (with propeller nuts, magnetos, carburetor) 650 lbs. Weight in lbs./h.p. 1.75. Fuel consumption at rated h.p. .55 lb./b.h.p./hr. Oil consumption at rated h.p. .025 lb./b.h.p./hr. Fuel octane rating 73.

**Construction.** Crankcase cast aluminum alloy; two-piece. Crankshaft forged nickel chromium steel; two-piece. Cylinders forged steel with integral fins. Cylinder heads cast aluminum alloy; cast fins; heads screwed and shrunk onto barrels. Pistons full trunk type; aluminum alloy forged, with three compression and three oil piston rings to each cylinder. Dry sump type lubrication, pressure feed. Connecting rods forged nickel chromium steel; one piece master rod. Rear section accessory drive provided with starter, generator, magnetos, tachometer, fuel and oil pumps, vacuum pump and synchronizer drives. Solid stem tulip type valves.

**Accessories.** G. E. supercharger, Scintilla magnetos, Stromberg carburetor, Eclipse generator and starter, BG spark plugs, Evans or Romec fuel pump, American Hammered piston rings, Jadson Fercrome valves, Air Associates radio shielding.



## KINNER R5 and R5 Series 2 — 5-cylinder—radial — ATC 77-153

Models R5 and R5 Series 2 (data on latter indicated in brackets).

**Specifications.** Direct drive, air-cooled. Department of Commerce and manufacturer's rating 160 h.p. at 1975 (1850) r.p.m. Compression ratio 5:1 (5.5:1). Bore 4.87″ (5″); stroke 5.25″ (5.5″); displacement 490 (540) cu. in. Length 32.3″; diameter 45.37″ (45.687″). Weight (without propeller nut, magnetos, carburetor) 305 (330) lbs. Weight in lbs./h.p. at sea level 1.91 (2.06). Fuel consumption at rated h.p. .55 lb./b.h.p./hr. Oil consumption at rated h.p. .025 lb./b.h.p./hr. Octane fuel rating 73.

**Construction.** Crankcase cast aluminum alloy; one piece. Crankshaft forged nickel chrome steel; one piece. Cylinders forged steel with fins integral. Cylinder heads cast aluminum alloy; cast fins; heads bolted to barrel. Pistons full trunk type; aluminum alloy, with three compression and one oil piston ring to each cylinder. Circulating, pressure feed lubrication. Connecting rods forged nickel chromium steel with one-piece master rod. Rear section accessory drive provided with starter, magnetos, generator, tachometer, fuel and oil pump drives. Solid stem tulip type intake and exhaust valves. Ball thrust bearings.

**Accessories.** Scintilla magnetos, Stromberg carburetor, Eclipse starter and generator, BG spark plugs, American Hammered piston rings, Romec or Evans fuel pumps, Air Associates radio shielding.



## KINNER C7 — 7-cylinder—radial — ATC 122

**Specifications.** Direct drive, air-cooled. Department of Commerce and manufacturer's rating 300 h.p. at 1800 r.p.m. Compression ratio 5.25:1. Bore 5.625″; stroke 6″; displacement 1044 cu. in. Blower gear ratio 1:1. Length 44.125″; diameter 51.312″. Weight 600 lbs. Weight in lbs./h.p. at sea level 2. Fuel consumption at rated h.p. .55 lb./b.h.p./hr. Oil consumption at rated h.p. .025 lb./b.h.p./hr.

**Construction.** Crankcase Bohn and Aluminum Company of America cast aluminum alloy, in two sections; bolted together on centerline of cylinders. Crankshaft SAE 3140 forged Bethlehem steel; two piece; carried on three anti-friction bearings; one piece master rod having a bearing of steel backed copper lead. Cylinders forged SAE 1050 Bethlehem steel. Cylinder heads Bohn cast aluminum alloy; with rocker boxes built integral with head screwed and shrunk cylinder barrel. Pistons full skirt type; Bohn cast aluminum alloy with three compression and two oil rings to each cylinder. Dry sump, pressure static lubrication to all bearings; splash to pistons. Link rods forged SAE 3140 steel. Electric accessories mounted at or above centerline, other accessories below center line.

**Accessories.** Scintilla magnetos, Stromberg carburetor, Eclipse electric or inertia starter, BG spark plugs, Air Associates radio shielding, C5, Evans or Romec fuel pump, oil filter, Jadson Fercrome valves.



## KINNER B-5 — 5-cylinder—radial — ATC 51

**Specifications.** Direct-drive, air-cooled. Department of Commerce and manufacturer's rating 125 h.p. at 1925 r.p.m. Compression ratio 5.25:1. Bore 4.625″; stroke 5.25″; displacement 441 cu. in. Length 32.31″; diameter 45.37″. Weight (without propeller hub, air heater, exhaust collector ring and starter) 295 lbs. Weight in lbs./h.p. at sea level 2.36. Fuel consumption at rated h.p. .55 lbs./b.h.p./hr. Oil consumption at rated h.p. .025 lbs./b.h.p./hr. Fuel octane rating 73.

**Construction.** Crankcase, barrel type aluminum alloy. Crankshaft, one-piece; SAE 3140 steel; single throw type, counterbalanced with single-row radial thrust bearing. Cylinders forged SAE 1050 steel with integral fins. Cylinder heads cast aluminum alloy bolted on barrels; valve seats, bronze; shrunk into head. Pistons, full skirt type of Bohn aluminum alloy with three compression and one oil ring to each cylinder. Split type master rod and link rods forged and machined all over. Steel backed copper lead bearings with ball thrust bearings. Pressure lubrication, circulating system. Valve gear, five separate camshafts, driven at half engine speed with conventional type cams, followers and tappets; overhead rocker arms actuated by push rods and are enclosed in detachable covers.

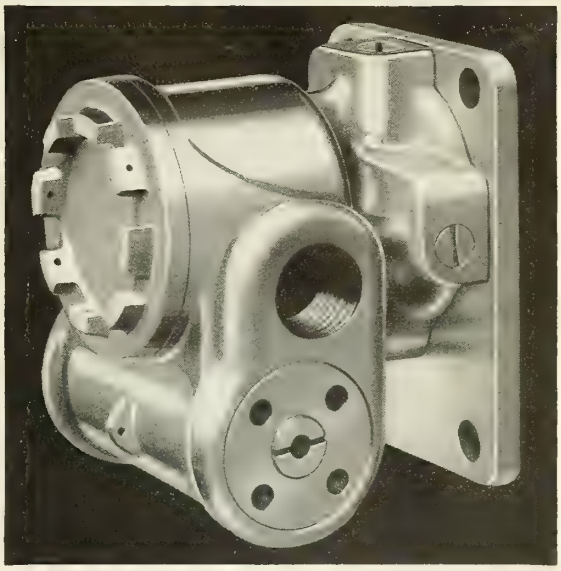
**Accessories.** Scintilla or Bosch magnetos (2), Stromberg or Holly carburetor, Eclipse air starter, BG spark plugs, Jadson-Fercrome intake and exhaust valves, American Hammered piston rings, radio shielding.

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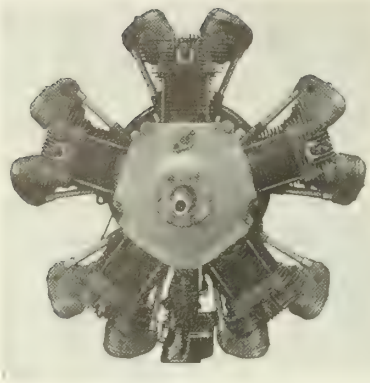
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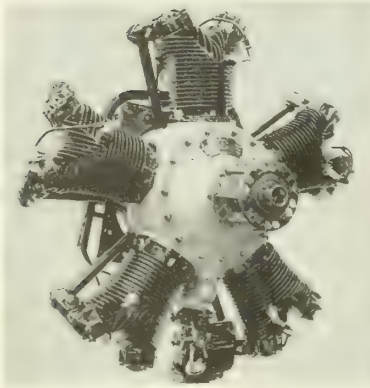


## LAMBERT (Monocoupe) R-266 — 5-cylinder—radial — ATC 38

**Specifications.** Direct drive, air-cooled. Department of Commerce and manufacturer's rating 90 h.p. at 2375 r.p.m. Cruising rating 60 h.p. at 5000 ft. Compression ratio 5.55:1. Bore 4.25″; stroke 3.75″; displacement 266 cu. in. Length 30″; height 34″; diameter 34″. Weight (with magnetos, carburetor, and carburetor heater) 225 lbs. Weight in lbs./h.p. at sea level 2.5. Fuel consumption at rated h.p. .55 lb./b.h.p./hr. Oil consumption at rated h.p. .025 lbs./b.h.p./hr. Fuel octane rating 70.

**Construction.** Crankcase magnesium alloy; two piece, joined on cylinder centerline; machine finished. Crankshaft steel SAE 3140; two piece, single throw. Cylinders nickel semi-steel castings with integral fins, loosely fitted on head permitting easy detachment. Cylinder heads heat treated aluminum alloy, bolted to crankcase with four long bolts. Pressure and dry sump lubrication; gear pressure to rod bearings and gearshafts; spray to pistons, pins, crankshaft bearings, and gears. Connecting rods SAE 3140 steel; one master and four link rods. Ball bearings on crankshaft. Starter drive on crankshaft; magneto drive provided. Pistons aluminum alloy, trunk type with two compression and two oil piston rings per cylinder. Tulip type intake and exhaust valves.

**Accessories.** Bendix magneto, Stromberg carburetor, Eclipse starter, Champion No. 13 spark plugs, Perfect Circle piston rings, Wilcox-Rich valves.

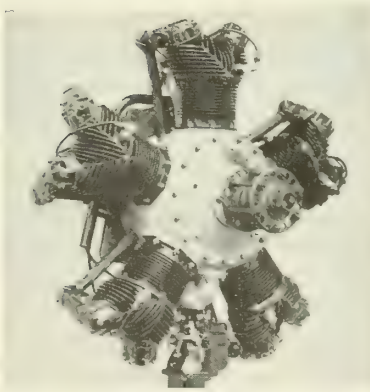


## LEBLOND 70 Model 5E — 5-cylinder—radial — ATC 48

**Specifications.** Direct drive, air-cooled. Department of Commerce rating 75 h.p. at 2075 r.p.m.; manufacturer's rating 70 h.p. at 1950 r.p.m. Compression ratio 5.35:1. Bore 4.125″; stroke 3.75″; displacement 250.5 cu. in. Length 23.75″; height 37.375″; diameter 33.25″. Weight (with carburetor, two magnetos; no hub) 245 lbs. Weight in lbs./h.p. at sea level 3.26. Fuel consumption .6 lb./b.h.p./hr. Oil consumption .015 lb./b.h.p./hr. Fuel octane rating 70.

**Construction.** Crankcase cast aluminum alloy with integrally cast intake manifold; one piece. Crankshaft forged chrome nickel steel; one piece; oil cleaner plug in crankpin. Cylinder and cylinder head cast in one piece of cast iron with heads and fin integral; two valves in head. Pistons permanent mold aluminum alloy casting; two compression and one oil piston ring to each cylinder; full floating piston pins. Dry sump, full pressure feed lubrication; duplex gear type pump and integral oil filter. Ball bearings for crankshaft main and rocker arm bearings; cadmium silver for connecting rod. Connecting rod drop forged chrome nickel steel; split big end; wrist pins locked by connecting rod bolts.

**Accessories.** Scintilla magnetos, Stromberg carburetor, Champion or BG spark plugs, Perfect Circle piston rings, Jones Motrola diaphragm fuel pump, Wilcox Rich valves. Optional equipment includes Bosch or Eclipse starter and radio shielding.



## LEBLOND 90 Model 5F — 5-cylinder—radial — ATC 46

**Specifications.** Direct drive, air-cooled. Maximum rating by Department of Commerce 90 h.p. at 2250 r.p.m. Compression ratio 6:1. Bore 4.25″; stroke 3.75″; displacement 266 cu. in. Length 23.75″; height 37.37″; diameter 33.25″. Weight (including carburetor and two magnetos) 226 lbs. Weight in lbs./h.p. at sea level 2.5. Fuel consumption at rated h.p. .55 lb./b.h.p./hr. Oil consumption at rated power .015 lb./b.h.p./hr. Fuel octane rating 65.

**Construction.** Crankcase, one-piece, cast-aluminum alloy; intake manifold cast integral. Crankshaft, one-piece chrome nickel steel forging; oil cleaner plug in crankpin. Cylinders machined from forgings. Cylinder heads aluminum alloy, bolted to cylinder barrel; one intake and one exhaust valve in head. Pistons permanent mold aluminum alloy; two compression and one oil piston ring to each cylinder; full skirt; full floating pins. Articulated type connecting rod, drop forged of chrome nickel steel; split big end type. Ball bearings for crankshaft and rocker arms. Auxiliary gears in unit assembly containing all accessories which may be removed without altering valve or ignition timing. Dry sump, full pressure feed lubrication.

**Accessories.** Scintilla type SB-5 magnetos, (2), Stromberg type NAR-3 carburetor, Champion or BG spark plugs, aluminum Industries tulip type intake and exhaust valves, Perfect Circle piston rings. Optional equipment includes Eclipse starter.



## LEBLOND 110 Model 7F — 7-cylinder—radial — ATC 52

**Specifications.** Direct drive, air-cooled. Department of Commerce rating 110 h.p. at 2150 r.p.m.; manufacturer's rating 119 h.p. at 2275 r.p.m. Compression ratio 5.4:1. Bore 4.25″; stroke 3.75″; displacement 372 cu. in. Length 24.562″; height 38.625″; diameter 33.25″. Weight (with carburetor, magnetos, but without propeller hub) 275 lbs. Weight in lbs./h.p. at sea level 2.31. Fuel consumption at sea level .54 lb./b.h.p./hr. Oil consumption at sea level .015 lb./b.h.p./hr. Octane fuel rating 70.

**Construction.** Crankcase cast aluminum alloy with integrally cast intake manifold; one piece. Crankshaft forged chrome nickel steel; one piece; oil cleaner plug in crankpin. Cylinders machined from steel forgings. Cylinder heads aluminum alloy bolted to cylinder barrel. Pistons permanent mold aluminum alloy casting with two compression and one oil piston ring to each cylinder; full floating pins; pistons full skirt type. Dry sump full pressure feed lubrication; duplex gear type pump and integral filter. Marlin Rockwell ball bearings for crankshaft. Connecting rods drop forged chrome nickel steel; split big end; floating piston pins. One intake and exhaust valve to each cylinder.

**Accessories.** Scintilla magnetos type MN-7D, Stromberg NAR-3 carburetor, Champion or BG spark plugs, Wilcox Rich intake and exhaust valves, Perfect Circle piston rings, Jones Motrola diaphragm type fuel pump.

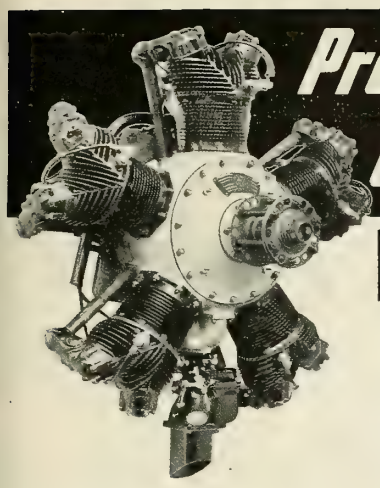


*Illustration shows the New Model 5-F LeBlond 90*

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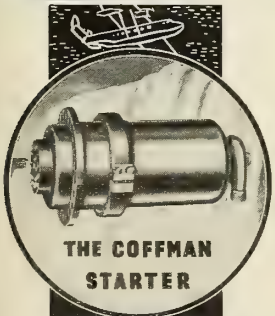
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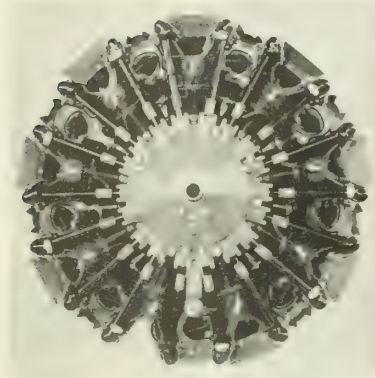
## LYCOMING R-680-B5 and R-680-B6 9 cylinders ATCs110-111

Models R-680-B5 and R-680-B6 (data on latter indicated in brackets). These models are for use with controllable pitch propellers.

**Specifications.** Direct drive, air-cooled. Department of Commerce rating 260 (245) h.p. at 2300 r.p.m. for take-off; normal rating 240 (225) h.p. at 2000 (2100) r.p.m. Compression ratio 6.5:1 (5.5:1). Blower gear ratio 1:1. Bore 4.625"; stroke 4.5"; displacement 680.4 cu. in. Length 36.343"; diameter 43.25". Weight (with carburetor, magneto, ignition harness, spark plugs and accessory drives) 495 (492.5) lbs. Weight in lbs./h.p. at sea level 1.9 (2.19). Fuel consumption at rated h.p. .55 lb./b.h.p./hr. Oil consumption at rated h.p. .025 lb./b.h.p./hr. Octane fuel rating 80 (73).

**Construction.** Crankcase, heat-treated aluminum alloy casting; main bearing plate aluminum alloy forging; thrust bearing housing and accessory drive housing, magnesium alloy casting. Crankshaft two-piece, single throw; chrome nickel steel. Cylinders machined carbon steel. Cylinder heads cast aluminum alloy, screwed and shrunk on machined carbon steel barrel. Pistons forged aluminum alloy with full floating piston pins with four rings above piston pin and one below. Pressure lubrication; two scavenging pumps.

**Accessories.** Scintilla magneto, Bendix-Stromberg carburetor, Eclipse starter and generator, BG spark plugs, Romec or Evans fuel pump, Wilcox-Rich valves.



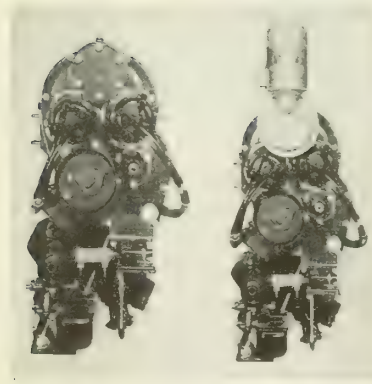
## LYCOMING R-680-B2 and R-680-B4 9 cylinders ATCs 81-108

Models R-680-B2 and R-680-B4 (data on latter indicated in brackets).

**Specifications.** Direct drive, air-cooled. Department of Commerce rating 240 (225) h.p. at 2000 (2100) r.p.m. Compression ratio 6.5:1 (5.5:1). Blower gear ratio 1:1. Bore 4.625"; stroke 4.5"; displacement 680.4 cu. in. Length 36.343"; diameter 43.25". Weight (with carburetor, magneto, ignition harness, spark plugs and accessory drives) 495 (492.5) lbs. Weight in lbs./h.p. at sea level 1.9 (2.19). Fuel consumption at rated h.p. .55 lb./b.h.p./hr. Oil consumption at rated h.p. .025 lb./b.h.p./hr. Octane fuel rating 80 (73).

**Construction.** Crankcase, heat-treated aluminum alloy casting; main bearing plate aluminum alloy forging; thrust bearing housing and accessory drive housing, magnesium alloy casting. Crankshaft two-piece, chrome-nickel steel; single throw. Cylinders machined carbon steel. Cylinder heads cast aluminum alloy, screwed and shrunk on machined carbon steel barrel. Pistons forged aluminum alloy with full floating piston pins with four rings above piston pin and one below. Master rod, one-piece construction machined from chrome nickel steel forging, with steel back high lead bronze bearing and 8 Lynite connecting rods. Pressure lubrication.

**Accessories.** Scintilla magneto, Bendix-Stromberg carburetor, Eclipse starter and generator, BG spark plugs, Romec or Evans fuel pump, Wilcox-Rich valves.

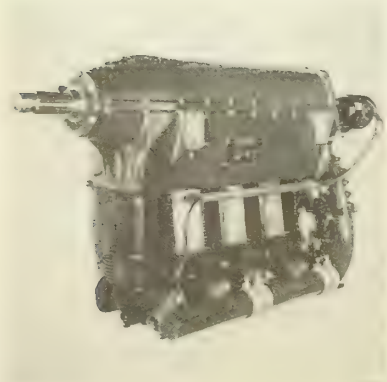


## MENASCO B4 Pirate 4-cylinder—inverted in-line ATC 65

**Specifications.** Direct drive, air-cooled. Department of Commerce and manufacturer's rating 95 h.p. at 2000 r.p.m. Compression ratio 5.5:1. Bore 4.5"; stroke 5.125"; displacement 326 cu. in. Length 47.75"; height 28"; width 11.125". Weight (without accessories) 290 lbs. Weight per h.p. 3 lbs. Fuel consumption at rated horsepower .54 lb./b.h.p./hr. Oil consumption at rated horsepower .006 lb./b.h.p./hr.

**Construction.** Crankcase cast aluminum alloy in two sections split along crankshaft centerline; braced and ribbed. Crankshaft Wyman-Gordon chrome nickel steel carried on five main bearings and one ball thrust bearing. Cylinders cast iron or steel with long sleeves protruding into crankcase to provide oil baffles. Cylinder heads cast aluminum alloy with bronze valve seats shrunk and screwed into barrel; secured to crankcase by 4 long studs. Pistons cast aluminum alloy with three compression and one oil ring to each cylinder. Connecting rods I section forged duralumin. Bearings bronze backed and babbitt lined. Dry sump lubrication with full pressure to all bearings with one pressure and two scavenging pumps. Accessories mounted on or in rear accessory case.

**Accessories.** Bosch or Scintilla magnetos, Stromberg carburetor, Eclipse or Bosch starter, B. G. spark plugs, Evans fuel pump, screen-type oil and air filters. Also available in battery ignition. Jadson intake and exhaust valves.



## MENASCO Pirate C4 and C4S 4-cylinders ATCs 67-134

Models C4 and C4S (data on latter indicated in brackets).

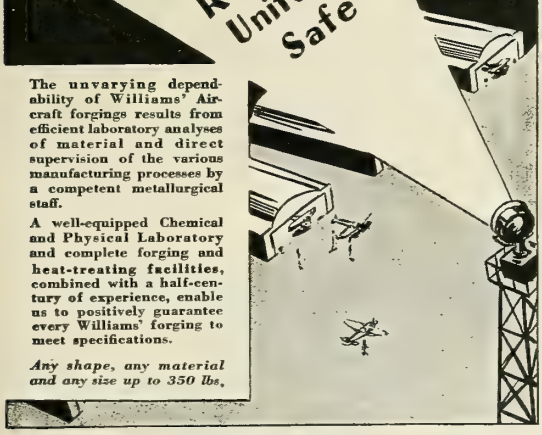
**Specifications.** Direct drive, air-cooled. Department of Commerce and manufacturer's rating 125 (150) h.p. at 2175 (2260) r.p.m. (at 3000 ft.). Compression ratio 5.5:1. (C4S is supercharged, with a blower gear ratio of 9.6:1). Bore 4.75"; stroke 5.125"; displacement 363 cu. in. Length 47.75" (47.53"); height 28" (28.562"); width 11.125". Bare weight 293 (305) lbs. Weight in lbs./h.p. 2.32 (2.03). Fuel consumption at rated h.p. .50 (.47) lb./b.h.p./hr. Oil consumption at rated h.p. .010 (.025) lb./b.h.p./hr.

**Construction.** Crankcase cast aluminum alloy in two sections; split on centerline of crankshaft; lower section heavily ribbed. Crankshaft Wyman-Gordon chrome nickel steel, one piece; SAE 3240; five bronze backed babbitt metal main bearings and one ball thrust bearing. Cylinders cast nickel iron or SAE 3140 steel. Cylinder heads cast aluminum alloy attached to crankcase by four nickel steel bolts. Pistons cast aluminum alloy with 3 (4) compression and one oil ring to each cylinder. Bearings bronze backed and babbitt metal lined. Dry sump, pressure lubrication from external tank to all bearings; one pressure and two scavenging pumps. Connecting rods forged I section duralumin.

**Accessories.** Scintilla or Bosch magnetos, Stromberg carburetor, Eclipse starter, Jadson intake and exhaust valves. Centrifugal type supercharger on model C4S.

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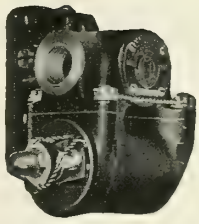


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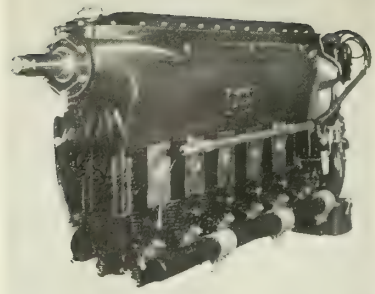
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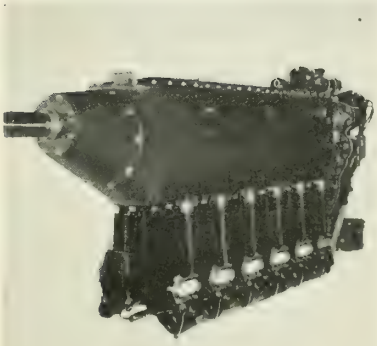


## MENASCO Buccaneer B6 and B6S 6-cylinders ATCs 68-139



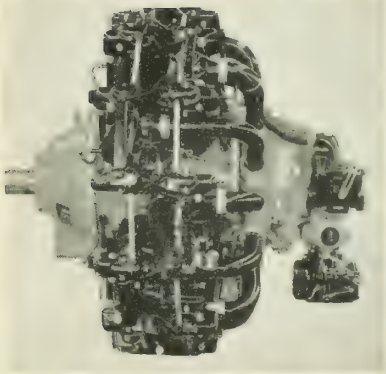
Models B6 and B6S (data on latter indicated in brackets.).
**Specifications.** Direct drive, air-cooled. Department of Commerce and manufacturer's rating 160 (200) h.p. at 1975 (2250) r.p.m. (at 4500 ft.). Compression ratio 5.5:1 (B6S is supercharged with a blower gear ratio of 8.75:1). Bore 4.5″; stroke 5.125″; displacement 489 cu. in. Length 59.43″; height 28.31″; width 11.87″. Bare weight 385 (415) lbs.; with accessories 398 (428) lbs. Weight in lbs./h.p. 2.4 (2.08). Fuel consumption at rated h.p. .54 (.56) lb./b.h.p./hr. Oil consumption .006 (.025) lb./b.h.p./hr.
**Construction.** Crankcase cast aluminum alloy; heavily ribbed; one piece cast magnesium cover plate. Crankshaft Wyman-Gordon chrome nickel steel; one piece, SAE 3240; steel backed cadmium-silver alloy lining main and connecting rod bearings. Cylinders cast nickel iron or SAE 3140 steel. Cylinder heads cast aluminum alloy attached to crankcase by four nickel steel studs. Pistons cast aluminum alloy special ribbed waffle head design with 3 (4) compression and one oil ring to each cylinder. Dry sump, pressure lubrication to all main and connecting rod bearings; one pressure and two scavenging pumps.
**Accessories.** Bosch magnetos, Stromberg carburetor, Eclipse starter, BG spark plugs, Evans fuel pump, Sealed Power piston rings; centrifugal type supercharger on B6S; Jadson exhaust and intake valves.

## MENASCO C6S-4 Super-Buccaneer 6-cylinders *ATC



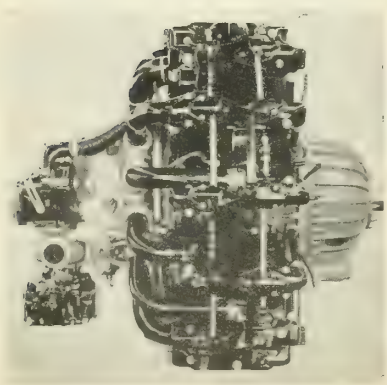
*ATC pending.
**Specifications.** Direct drive, air-cooled. Manufacturer's rating 250 h.p. at 2280 r.p.m. at 5000 ft. Cruising rating 165 h.p. at 2000 r.p.m. at 9000 ft. Power available for take off 290 at 2400 r.p.m. at 50″ Hg. manifold pressure. Compression ratio 5.5:1. Blower gear ratio 10.9:1. Bore 4.75″; stroke 5.125″; displacement 544 cu. in. Length 72.687″; height 30.593″; width 12.875″. Weight (with standard equipment except air scoop, fuel pump, or propeller hub) 490 lbs. Weight in lbs./h.p. 1.96 lbs. Fuel consumption .54-.56 lb./b.h.p./hr. Oil consumption .025 lb./b.h.p./hr. Fuel octane rating 80.
**Construction.** Crankcase aluminum alloy casting, one piece with cast magnesium cover plate; nose section and separate rear accessory case. Crankshaft six throw, pressure lubricated; SAE No. 20 spline hub. Cylinders steel, machined from ring forging, finned; heads screwed and shrunk onto steel barrel. Cylinder heads cast aluminum alloy, finned with oval ports and swept back passages; semi-spherical combustion chambers; spark plugs on center line, vertical. Pistons aluminum alloy cast waffle head type, full skirt; five rings, four compression above pin; one oil below wrist pin. Pressure feed and double scavenging, automatic lubrication.
**Accessories.** Menasco centrifugal type supercharger, Scintilla magneto or battery ignition, Stromberg carburetor, Eclipse starter and generator, BG spark plugs.

## PRATT & WHITNEY Twin Wasp 14-cylinders—radial ATC 158



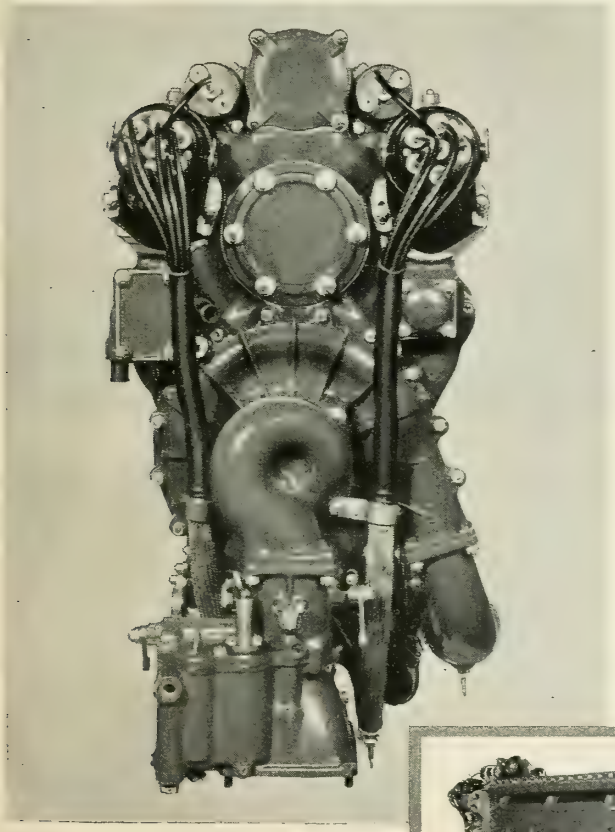
**Specifications.** Geared, air-cooled. Department of Commerce and manufacturer's rating (maximum) 900 h.p. at 2450 r.p.m. at 6400 ft. Manufacturer's cruising rating 625 h.p. at 2200 r.p.m. at 13,000 ft.; power available for take-off 1000 at 2600 r.p.m. at 41.3″ Hg. manifold pressure. Compression ratio 6.5:1; blower gear ratio 12:1; propeller shaft ratio 3:2. Bore 5.5″; stroke 5.5″; displacement 1830 cu. in. Length 55.5″; diameter 48″. Weight (including carburetor, magnetos, oil pump, spark plugs, plain wiring, tachometer drive and generator drive) 1235 lbs. Weight in lbs./h.p. at sea level 1.23. Fuel consumption at cruising h.p. .48 lb./b.h.p./hr. Oil consumption at rated h.p. .035 (max.) lb./b.h.p./hr. Fuel octane rating 87.
**Construction.** Crankcase, forged dural. Crankshaft, forged steel; one-piece. Cylinders forged steel with cast aluminum cylinder heads, screwed and shrunk onto barrels. Forged aluminum pistons with four compression and one oil scraper ring to each cylinder. Forged steel I-section connecting rods; two-piece master rods. Ball and roller bearings. Forced feed lubrication. Rear accessory drive section cast magnesium or aluminum. Cylinders arranged in two staggered banks of seven cylinders each.
**Accessories.** General Electric centrifugal gear-driven supercharger, Scintilla magnetos (2), Stromberg carburetor, BG spark plugs, Thompson valves, P & W radio shielding, gear-driven oil pump.

## PRATT & WHITNEY Twin Wasp Junior 14 cylinders *ATC



Model S3A5-G. *ATC pending.
**Specifications.** Geared, air-cooled. Manufacturer's rating (maximum) 700 h.p. at 2500 r.p.m. at 8500 ft. Manufacturer's cruising rating 485 h.p. at 2200 r.p.m. at 14,000 ft.; power available for take-off 750 at 2500 r.p.m. at 33″ Hg. manifold pressure. Compression ratio 6.7:1; blower gear ratio 10:1; propeller shaft ratio 4:3 or 3:2. Bore 5.187″; stroke 5.187″; displacement 1535 cu. in. Length 53.25″; diameter 44.125″. Weight (including carburetor, magneto, oil pump, spark plugs, plain wiring, tachometer and generator drives) 1070 lbs. Weight in lbs./h.p. at sea level 1.35. Fuel consumption at cruising h.p. .48 lbs./b.h.p./hr. Oil consumption at rated h.p. .035 (max.) lb./b.h.p./hr. Fuel octane rating 87.
**Construction.** Crankcase, forged dural. Crankshaft, forged steel; one-piece. Cylinders forged steel with cast aluminum cylinder heads, screwed and shrunk onto barrels. Forged aluminum pistons with four compression and one oil scraper ring to each cylinder. Forged steel I-section connecting rods; two-piece master rods. Ball and roller bearings. Forced feed lubrication. Rear accessory drive section cast magnesium or aluminum. Cylinders arranged in two staggered banks of seven cylinders each.
**Accessories.** General Electric centrifugal gear-driven supercharger, Scintilla magnetos (2), Stromberg carburetor, BG spark plugs, radio shielding, gear-driven oil pump.

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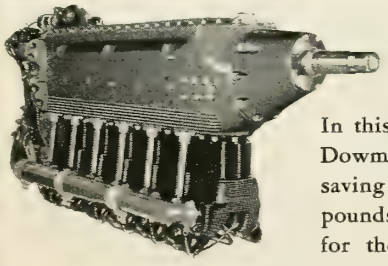
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In this engine, over fifty pounds of Dowmetal are used, resulting in a saving of approximately twenty-eight pounds over any other metal suitable for the same applications. Dowmetal results in a saving of 5 per cent in power-weight ratio.

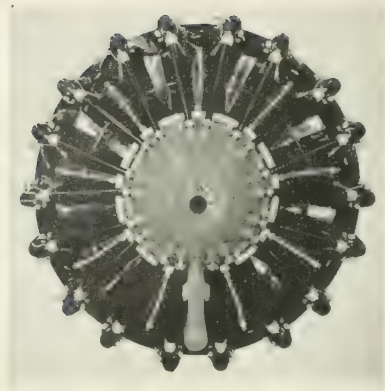
Of special interest is the fact that, in addition to numerous housing parts, Menasco also uses Dowmetal for supercharger impellers which, at times, operate at speeds of approximately 40,000 r.p.m.

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## PRATT & WHITNEY Wasp Junior 9-cylinder—radial ATCs 85-123

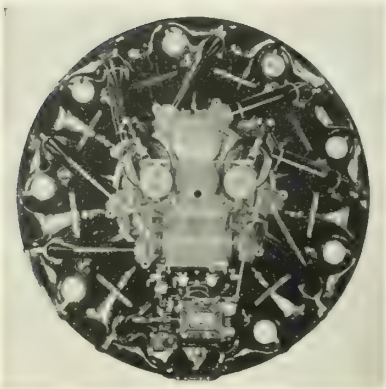
Models TB and SB (data on latter indicated in brackets).

**Specifications.** Direct drive; air-cooled. Maximum rating 400 h.p. at 2200 r.p.m. (400 h.p. at 2200 r.p.m. at 5000 ft.). Cruising rating 300 h.p. at 2000 r.p.m. at 7000 ft. (300 h.p. at 2000 r.p.m. at 9600 ft.); power available for take-off 440 at 2300 r.p.m. at 34.5" Hg. (450 at 2300 r.p.m. at 36.5" Hg.). Compression ratio 6:1; blower gear ratio 8:1 (10:1). Bore 5.187"; stroke 5.187"; displacement 985 cu. in. Length 42.12"; diameter 45.75". Weight 610 lbs. Weight in lbs./h.p. at sea level 1.38 (1.35). Fuel consumption at cruising h.p. .48 lb./b.h.p./hr. Oil consumption at rated h.p. .035 (max.) lb./b.h.p./hr. Fuel octane rating 80.

**Construction.** Crankcase, forged dural. Crankshaft, forged steel; two-piece, splined. Cylinders forged steel with cast aluminum cylinder heads, screwed and shrunk onto barrels. Forged aluminum pistons. Forged steel I-section connecting rods. Ball and roller bearings. Forced feed lubrication. Rear accessory drive section cast magnesium or aluminum; contains two auxiliary drives, tachometer, oil pump, fuel pump, vacuum pump, starter, generator and two magneto drives.

**Accessories.** General Electric supercharger, Scintilla magnetos (2), Stromberg carburetor, BG spark plugs, Thompson valves, P & W radio shielding, gear-driven oil pump.

*Other data in May,* 1936, AERO DIGEST.



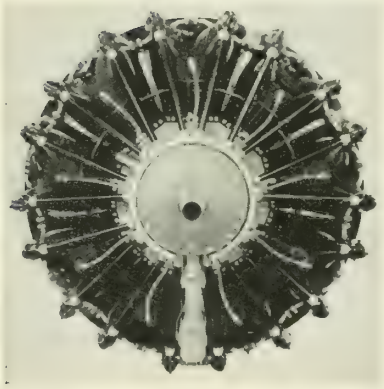
## PRATT & WHITNEY Wasp H Series 9-cylinder—radial *ATC

Models S3H1, S2H1 and S1H1-G; data given in that order. *ATC pending on model S2H1, #143 and #125 on models S3H1 and S1H1-G respectively.

**Specifications.** Direct-drive (S1H1-G, geared) air-cooled. Maximum rating 550 h.p. at 2200 r.p.m. at 5000 ft.; 500 h.p. at 2200 r.p.m. at 10,500 ft.; 550 h.p. at 2200 r.p.m. at 8000 ft. Cruising rating 400 h.p. at 2000 r.p.m. at 10,500 ft.; on S1H1-G, 400 h.p. at 2000 r.p.m. at 11,800 ft. Power available for take-off 550 at 2200 r.p.m. at 34.5" Hg.; 500 at 2200 r.p.m. at 32.5" Hg.; 600 at 2250 r.p.m. at 36" Hg. manifold pressure. Compression ratio 6:1; blower gear ratio 10:1; 12:1; 12:1. Gear ratio on S1H1-G 3:2. Length 44.06"; 44.06"; 48.87". Diameter 51.44". Weight (lbs.) 805; 805; 883. Weight in lbs./h.p. at sea level 1.46; 1.61; 1.47.

**Construction.** Crankcase, forged dural. Crankshaft, forged steel; two-piece, splined. Pistons, forged aluminum; 4 compression, 1 oil to each cylinder. Cylinders forged steel; heads, cast aluminum screwed and shrunk on barrels. Forged steel I-section connecting rods.

**Accessories.** General Electric supercharger, Scintilla magnetos (2), Stromberg carburetor, BG spark plugs, Thompson valves, P & W radio shielding. Above engines are in higher horsepower groups in Wasp H Series; other models include T1H1, 525 h.p. at 2100 r.p.m. S4H1, 450 h.p. at 2100 r.p.m. at 6000 ft.; T3H1, 420 h.p. at 2000 r.p.m.



## PRATT & WHITNEY Hornet E Series 9-cylinders—radial *ATC

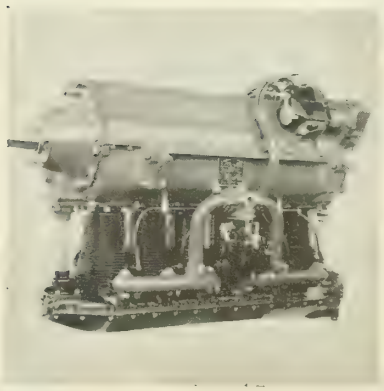
Models S5E, S1E-G, S13E-G; data given in that order. *ATCs: pending; 136; 166.

**Specifications.** S5E direct drive; others geared. Maximum rating 700 h.p. at 2050 r.p.m. at 6000 ft.; 750 h.p. at 2250 r.p.m. at 7000 ft.; 750 h.p. at 2250 r.p.m. at 4000 ft. Cruising rating (S5E omitted) 525 h.p. at 2000 r.p.m. at 12,800 ft;. 525 h.p. at 2000 r.p.m. at 10,800 ft. Power available for take-off 700 at 2050 r.p.m. at 35" Hg.; 800 at 2300 r.p.m. at 35" Hg.; 800 at 2300 r.p.m. at 35" Hg. Compression ratio 6.5:1; blower gear ratio 12:1; 12:1; 10:1; propeller shaft ratio 1:1; 3:2; 3:2. Bore 6.125"; stroke 6.375"; displacement 1690 cu. in. Length 45.37"; 51"; 51. Diameter 54.437". Weight (lbs.) 920; 1015; 1015.

**Construction.** Crankcase, forged dural. Crankshaft forged steel; two-piece, splined. Forged steel cylinders with cast aluminum cylinder heads screwed and shrunk onto barrels. Forged aluminum pistons. Forged steel I-section connecting rods. Forced feed lubrication.

**Accessories.** Supercharger, magnetos (2), carburetor, radio shielding, gear-driven oil pump starter.

Above engines are in higher horsepower group in Hornet E Series; other models include S2E-G, 750 h.p. at 2250 r.p.m. at 2500 ft.; S3E-G, 675 h.p. at 2250 r.p.m. at 6000 ft.; T2E, 650 h.p. at 2000 r.p.m.; S9E, 650 h.p. at 2050 r.p.m. at 3000 ft.; S10E, 575 h.p. at 2000 r.p.m. at 2000 ft.; S11E, 525 h.p. at 2000 r.p.m. at 4000 ft.



## RANGER 6-390-D3 6-cylinder—inverted in-line ATC 146

**Specifications.** Direct drive, air-cooled. Department of Commerce rating 150 h.p. at 2350 r.p.m. Compression ratio 6:1. Bore 4"; stroke 5.125"; displacement 386.4 cu. in. Length 50.87"; height 31.78"; width 20.25". Weight (with magnetos, oil pump, carburetor, spark plugs, hot spot and ignition wiring) 355 lbs. Weight in lbs./h.p./at sea level 2.4. Fuel consumption at rated h.p. .55 lb./b.h.p./hr. Oil consumption at rated horsepower .025 pound per brake horsepower per hour. Octane fuel rating 73.

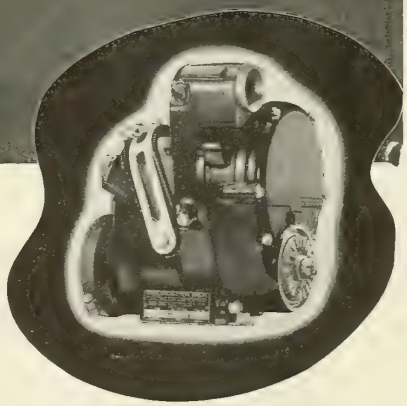
**Construction.** Crankcase heat treated cast aluminum alloy; two piece. Crankshaft conventional six throw, seven bearing type; machined from heat-treated chrome nickel steel forging. Main bearings bronze babbitt lined. Cylinders machined from extruded heat treated carbon steel. Cylinder heads heat-treated cast aluminum alloy. Pistons heat-treated cast aluminum alloy; trunk type ribbed with three compression and one oil ring; full floating piston pins machined from heat-treated nickel steel. Engine pressure feed lubrication to all bearings. Connecting rods heat-treated chrome molybdenum steel forgings. Bronze, babbitt lined bearings. Underhead camshaft type valve gear, enclosed by cast aluminum housing, cover of which serves as engine oil sump.

**Accessories.** Two single magnetos and a carburetor. Provision also is made for the installation of a starter, generator, fuel pump and tachometer drives.

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## RANGER V-770-B3 — 12-cylinder—inverted Vee — *EXP.



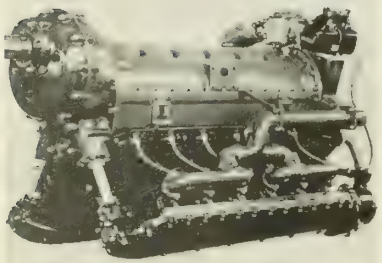
*Application made for Approved Type Certificate.

**Specifications.** Direct drive, air-coo'ed; cylinders arranged in two banks of six each. Manufacturer's rating 290 h.p. at 2300 r.p.m. Compression ratio 6:1. Bore 4″; stroke 5.125″; displacement 772.8 cu. in. Length 59.218″; height 27.187″; width 28″. Weight (with magnetos and distributors, oil pump, carburetor, hot spot, spark plugs and ignition wiring) 550 lbs. Weight in lbs./h.p. at sea level 1.9. Fuel consumption at sea level at rated h.p. .55 lb./b.p.h./hr. Oil consumption at sea level at rated h.p. .025 lb./b.p.h./hr. Fuel octane rating 73.

**Construction.** Crankcase heat treated cast aluminum alloy; two piece. Crankshaft conventional six throw, seven bearing type; machined from heat-treated chrome nickel steel forging. Cylinders machined from extruded heat-treated alloy steel. Cylinder heads heat treated cast aluminum alloy. Pistons heat treated cast aluminum alloy; trunk type with three compression and one oil piston ring to each cylinder. Pressure feed lubrication to all bearings. Connecting rods conventional blade and forked type; machined from heat-treated chrome molybdenum steel forgings. Bearings bronze, steel backed babbitt lined.

**Accessories.** One double magneto and two carburetors. Provision also is made for the installation of a starter, generator, fuel pump and tachometer drive.

## RANGER SGV-770-A — 12-cylinder—inverted Vee — ATC 84



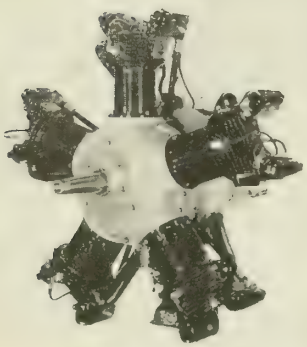
**Specifications.** Geared, air-cooled; cylinders arranged in two banks of six each. Manufacturer's rating 420 h.p. at 2800 r.p.m. Compression ratio 6:1. Blower gear ratio 7.71:1. Propeller shaft ratio 3:2. Bore 4″; stroke 5.125″; displacement 772.8 cu. in. Length 59.843″; height 31.812″; width 28″. Weight (with magneto, distributors, carburetor, hot spot, spark plugs and ignition wiring) 635 lbs. Weight in lbs./h.p. at sea level 1.5. Fuel consumption at rated h.p. .55 lb./b.h.p./hr. Oil consumption at rated horsepower .025 lb./b.h.p./hr. Fuel octane rating 87.

**Construction.** Crankcase heat treated cast aluminum alloy; two piece. Crankshaft conventional six throw, seven bearing type; machined from heat-treated chrome nickel steel forging. Main bearings bronze babbitt lined. Cylinders machined from extruded heat treated alloy steel. Cylinder heads heat treated cast aluminum alloy; trunk type with three compression and one oil piston ring to each cylinder. Pressure feed lubrication to all bearings. Connecting rods blade and forked type; machined from heat treated chrome molybdenum steel forgings. Bearings bronze, steel backed babbitt lined.

**Accessories.** One double magneto and one double carburetor. Provision also is made for the installation of a starter, generator, fuel pump and two tachometer drives.

*Other data in April, 1935,* AERO DIGEST.

## WARNER Scarab Junior Series-50 — 5-cylinders — ATC 54

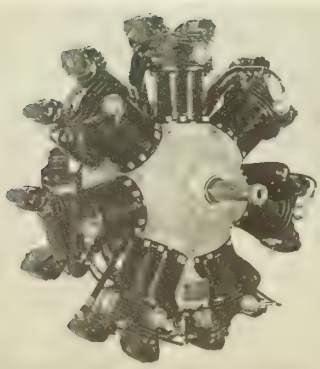


**Specifications.** Direct drive, air-cooled. Dept. of Commerce and manufacturer's rating 90 h.p. at 2025 r.p.m. Compression ratio 5.2:1. Bore 4.262″; stroke 4.25″; displacement 301 cu. in. Length (without starter) 28.5″; height 36.56″. Weight 235 lbs. Weight per h.p. at sea level 2.6 lbs. Fuel consumption .55 lb./b.h.p./hr. Oil consumption .025 lb./b.h.p./hr.

**Construction.** Crankcase heat treated aluminum alloy, in two halves joined on centerline; front and rear halves each carry steel sleeve to receive the crankshaft ball bearings. Crankshaft chrome nickel steel forging, one piece, single throw. Cylinders chrome molybdenum steel forgings, with heads permanently shrunk and bolted. Cylinder heads heat treated aluminum alloy, rocker arm housing cast integral with cylinder head. Pistons heat treated aluminum alloy, one oil, two compression piston rings to each cylinder. Ball bearings for main bearings, high lead bronze bearings for connecting rod. Master rod with split big end; wrist pins fixed in auxiliary rods and floating in master rod flanges; rods of I section. Accessory drives in rear of crankcase. Valves operated by push rods and overhead rockers; valve gear two four-lobe cam rings driven at one-eighth engine speed. Accessory drives are at the rear of the crankcase.

**Accessories.** Scintilla magnetos, Holley carburetor, AC spark plugs. Optional equipment includes starter, oil filter, air filter, thermocouples. Battery ignition available.

## WARNER Scarab Series-50 — 7-cylinders — ATCs 2-104



Models Scarab and Super Scarab (data on the latter indicated in brackets).

**Specifications.** Direct drive, air-cooled. Dept. of Commerce and manufacturer's rating 125 (145) h.p. at 2050 r.p.m. Compression ratio 5.2:1 (5.2:1). Bore 4.25″ (4.625″); stroke 4.25″; displacement 422 (499) cu. in. Length without starter 28.875″; height 36.56″. Weight 285 (305 lbs.). Weight per h.p. at sea level 2.25 (2.11) lbs. Fuel consumption .55 lb./b.h.p./hr. Oil consumption .025 lb./b.h.p./hr.

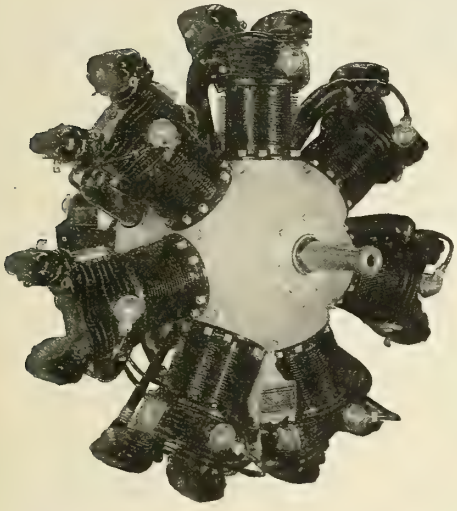
**Construction.** Crankcase heat treated aluminum alloy, in two halves joined on centerline; front and rear halves each carry steel sleeve to receive crankshaft ball bearings. Crankshaft chrome nickel steel forgings, single throw. Cylinders chrome molybdenum alloy steel forgings machined all over and finned. Cylinder heads heat treated aluminum alloy casting permanently shrunk and bolted to cylinder barrels. Pistons heat treated aluminum alloy, one oil, two compression piston rings to each cylinder. Main bearings are ball bearings, connecting rod bearings are high lead bronze. Lubrication force feed, dry sump; pressure and suction pumps in tandem in one unit. Master rod with split big end; wrist pins fixed in auxiliary rods and floating in master rod flanges.

**Accessories.** Scintilla magnetos, Stromberg carburetor, AC (BG) spark plugs. Optional equipment includes starter, oil filter, air filter and thermocouples.

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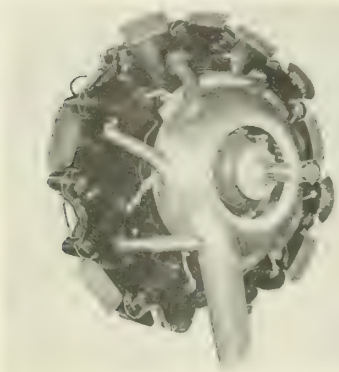
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## WRIGHT Whirlwind E Series — 7- and 9-cylinder—radial — ATC

The Whirlwind E series consists of seven engines, four 7-cylinder types and three 9-cylinder types; all are radial air-cooled, with full force feed, dry sump lubrication; they have a bore of 5″; stroke 5.5″, fuel consumption .55 lb./b.h.p./hr. and oil consumption of .025 lb./b.h.p./hr. Their basic construction is identical.

**Construction.** Crankshaft forged chrome nickel molybdenum steel; #20 and #30 spline; counter-balanced single throw type, in two sections to allow use of solid big-end master rod; runs in lead bronze journal bearing at rear and ball bearing at front end, provided with dynamic damper. Crankcase cast aluminum alloy cylindrical body with mounting bosses for cylinders; front cover carries thrust bearing; front crankshaft ball bearing carried in special diaphragm; rear section carries accessory gears. Pistons forged aluminum alloy, full trunk type with two oil and two compression piston rings to each cylinder. Cylinder barrels forged steel with integral fins screwed and shrunk into cast aluminum alloy cylinder heads on which fins are cast integral; side exhaust port permits use of either front or rear exhaust system; rocker support boxes cast integral with head; rocker box covers held in place by clamps and form a rigid support for installation of anti-drag ring cowl. Pistons aluminum alloy forgings, machined; concave or flat head types; underside of head ribbed to provide strength and additional cooling. Bearings either plain and anti-friction type. Connecting rods forged nickel steel; one-piece master rod and articulated rods all of I section; crank pin bearing anti-friction alloy, steel backed, shrunk and dowelled into master rod big end; piston pin and knuckle pin bushings bronze. Valves tulip shaped; valve springs helical, heat treated spring steel wire. Valve gear with hollow felt-filled tappets of hardened steel, with steel rollers running on cam ring, operate rocker arms through complete enclosed push rods. Inter-cylinder and cylinder head air deflectors provide full pressure baffling on supercharged models. Accessories mounted on rear crankcase section. Two ball bearings on crankshaft.

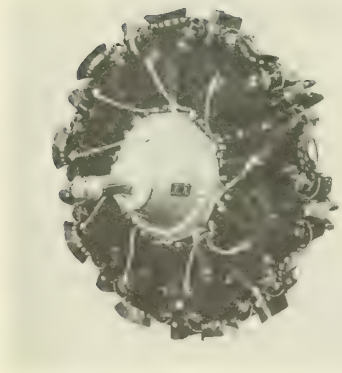
**Accessories.** G. E. internal centrifugal supercharger, Scintilla magnetos, Stromberg carburetor, B. G. spark plugs, Thompson and Wilcox Rich valves, Breeze radio shielding.



## WRIGHT Whirlwind R-760 — 7-cylinder—radial — *ATC

The R-760E series consists of four engines, R-760E, R760E-1, R-760E-2 and R-760ET. *ATCs No. 26, 94, 155 and 126 respectively. Weights indicated include (unless otherwise noted) magnetos, carburetor, propeller hub cones and nut, fuel pump and tachometer drives.

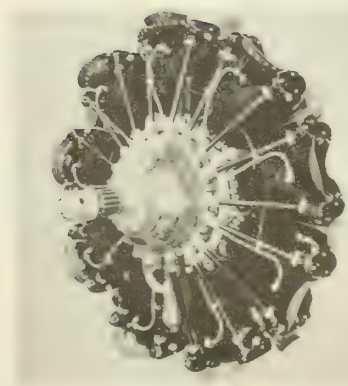
**Specifications.** Direct drive, air-cooled. Displacement 756 cu. in. Length 42.72″; diameter 45″. R-760E rated 250 h.p. at 2000 r.p.m.; cruising 185-195 at 1800-1850 r.p.m.; power available for take-off 250 h.p. at 2000 r.p.m.; compression ratio 5.1:1; blower gear ratio 7.05:1; weight (also with hydro-control propeller provision) 530 lbs.; weight in lbs./h.p. 2.12; fuel octane rating 73. R-760E-1 rated 285 h.p. at 2100 r.p.m. cruising 210-225 h.p. at 1900-1950 r.p.m.; power available for take-off 285 h.p. at 2100 r.p.m.; compression ratio 6:1; blower gear ratio 7.05:1; weight (also with cylinder baffles and hydro control propeller provision) 545 lbs.; weight in lbs./h.p. 1.92; fuel octane rating 73. R-760E-2 rated 320 h.p. at 2200 r.p.m.; cruising 210-225 h.p. at 1900-1950 r.p.m.; power available for take-off 350 h.p. at 2400 r.p.m.; compression ratio 6.30:1; blower gear ratio 9.17:1; weight (also with provision for hydro-control propeller, generator drive, cylinder baffles and automatic valve gear lubrication) 560 lbs. Weight in lbs./h.p. 1.75; 80 octane fuel. R-760ET rated 235 h.p. at 2000 r.p.m.; cruising 170-195 h.p. at 1800-1850 r.p.m.; no blower. Weight 515 lbs. 73 octane fuel.



## WRIGHT Whirlwind R975 — 9-cylinder—radial — *ATC

The R975 series consists of three engines, R975E, R975E1 and R975E3. *ATCs respectively No. 21, 87 and 125. Ratings given are both Department of Commerce and manufacturer's and weights indicated include, except noted otherwise, the following equipment: two magnetos, carburetor, propeller hub cones and nut, provision for hydro control propeller, fuel pump and tachometer drives.

**Specifications.** Direct drive, air-cooled. Displacement 973 cu. in. Length 43.47″; diameter 45″. R975E rated 330 h.p. at 2000 r.p.m.; cruising rating 240-260 r.p.m. at 1800-1850 r.p.m.; power available for take-off 330 h.p. at 2000 r.p.m.; compression ratio 5.1:1; blower gear ratio 7.8:1; weight 635 lbs.; weight in lbs./h.p. 1.91; fuel octane rating 73. R975E1 rated 365 h.p. at 2100 r.p.m.; cruising rating 270-290 h.p. at 1900-1950 r.p.m.; power available for take-off 365 h.p. at 2100 r.p.m.; compression ratio 6:1; blower gear ratio 7.8:1; weight (also with cylinder baffles) 645 lbs.; weight in lbs./h.p. 1.78; fuel octane rating 73. R975E3 rated 420 h.p. at 2200 r.p.m. at 1400 ft.; cruising rating 275-325 h.p. at 1900-2000 r.p.m.; power available for take-off 450 h.p. at 2250 r.p.m. at full throttle; compression ratio 6.3:1; blower gear ratio 10.15:1; weight (also with vacuum pump drive, cylinder baffles, generator drive and automatic valve gear lubrication) 660 lbs.; weight in lbs./h.p. 1.59; fuel octane rating 80.



## WRIGHT Cyclone G2 Series — 9-cylinder—radial — ATC 157

Models R-1820-G2 and GR-1820-G2 (data on latter indicated in brackets).

**Specifications.** Direct drive (geared), air-cooled. Department of Commerce and manufacturer's rating, maximum, 850 h.p. at 2100 r.p.m. at 5800 ft., and 820 h.p. at 2100 r.p.m. at sea level. Cruising rating 600 h.p. at 1900 r.p.m.; power available for take-off 1000 at 2200 r.p.m. at 40″ Hg. manifold pressure. Compression ratio 6.45:1; blower gear ratio 7:1; propeller shaft ratio on GR-1820-G2 16:11. Bore 6.125″; stroke 6.875″; displacement 1823 cu. in. Length 43.25″; (47.75″); diameter 54.25″; Weight 1068 (1163) lbs. Weight in lbs./h.p. at sea level 1.06 (1.16); at altitude 1.25 (1.67). Fuel consumption at cruising h.p. .43 lbs./b.h.p./hr. Oil consumption at rated h.p. .025 lbs./b.h.p./hr.

**Construction.** Crankshaft chrome nickel steel forgings, single throw; supported on 3 bearings; incorporates dynamic damper. Cylinder heads aluminum alloy casting with cylinders shrunk on to alloy steel barrels and fitted with pressure baffles. Forged aluminum alloy pistons, cross-ribbed on underside of head. Forged alloy steel I-section connecting rods; one-piece master; S link. Dry sump pressure feed lubrication; automatic built-in valve gear lubrication system.

**Accessories.** General Electric supercharger, Scintilla magnetos (2), Stromberg carburetor, Eclipse starter and generator, BG spark plugs, Thompson valves, Breeze radio shielding, Romec fuel pump.



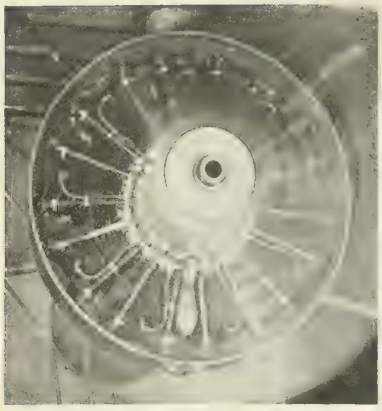

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## WRIGHT Cyclone G 100 Series — 9-cylinder—radial — ATC 169

Models R-1820-G102 and GR-1820-G102 (data on latter indicated in brackets).

**Specifications.** Direct drive (geared) air-cooled. Manufacturer's rating 900 h.p. at 2200 r.p.m. at 6000 ft. Cruising rating 625 h.p. at 1900 r.p.m.; take-off rating 1100 h.p. at 2300 r.p.m.; power available for take-off 1220 at 2300 r.p.m. Compression ratio 6.7:1; blower gear ratio 7:1; propeller shaft ratio on GR-1820-G102, 16:11. Bore 6.125"; stroke 6.875"; displacement 1823 cu. in. Length 43.25"; (47.75"); diameter 55". Weight 1180 (1275) lbs. Weight in pounds/horsepower at sea level 1.07 (1.15); at altitude 1.31 (1.41). Fuel consumption at cruising horsepower .43 lb./b.h.p./hr. Oil consumption at rated hr. .025 lb./b.h.p./hr.

**Construction.** Crankcase, steel main section. Crankshaft, chrome nickel steel forgings; single throw; supported on 3 bearings; incorporates dynamic damper. Cylinder heads, aluminum alloy casting with cylinders shrunk onto alloy steel barrels and fitted with pressure baffles. Forged aluminum alloy pistons, cross-ribbed on underside of head. Forged alloy steel I-section connecting rods; one-piece master; 8 link. Dry sump pressure feed lubrication; automatic built-in valve gear system.

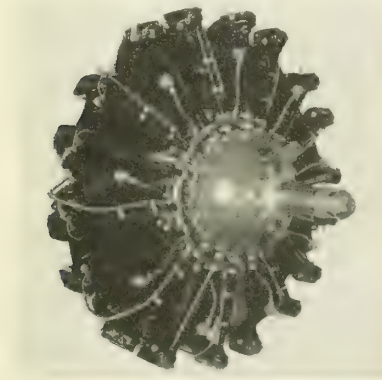
**Accessories.** General Electric supercharger, Scintilla magnetos (2), Stromberg carburetor, Eclipse starter and generator, BG spark plugs, Thompson valves, Breeze radio shielding, Romec fuel pump.

## WRIGHT Cyclone F Series — 9-cylinder—radial — ATC

The Cyclone F series consists of eight direct drive and eight geared models all of which are 9-cylinder radial, air-cooled, lubricated by the dry sump pressure feed method and having a bore of 6.12", stroke of 6.87" and displacement of 1823 cu. in.; fuel consumption at rated h.p. of .61 lb./b.h.p./hr., and oil consumption of .025 lb./b.h.p./hr. Their basic construction is practically similar.

**Construction.** Crankcase consists of nose section, main section, mounting, supercharger and accessory sections; nose section aluminum alloy forging which encloses cam and carries valve tappets their guides and oil passages and control valve for operation of hydraulically-controlled variable pitch propellers; main section forged aluminum alloy, two symmetrical parts joined at centerline of cylinders by bolts; cam drive gears located in forward part of main section; mounting section heat treated aluminum alloy casting which forms front wall of supercharger diffuser and distribution chamber and carries tangential ports for intake pipes; supercharger section attaches to rear mounting section; accessory section magnesium alloy forms the rear crankcase cover. Crankshaft chrome nickel steel forging, single throw supported on three bearings. Cylinders built up from forged steel barrels screwed and shrunk into cast aluminum alloy heads with integral valve mechanism housings and closely-spaced deep cooling fins and spark plug coolers; exhaust and intake ports at rear of head; exhaust rocker box provided with fins to improve cooling of exhaust valve; cylinder cooling augmented by system of inter-cylinder and inter-rocker box air deflectors. Pistons aluminum alloy forgings, cross-ribbed on underside of head; piston pins alloy steel, full floating type, with three compression, 2 oil and 1 scraper ring to each cylinder. Connecting rods forged alloy steel, I section; one piece master rod, eight link rods; crankpin bearing high lead bronze, steel backed, shrunk and pinned into big end of master rod; piston pin and knuckle pin bushings bronze. Bearings either plain or anti-friction type. Valves steel forging; exhaust valve filled with metallic sodium.

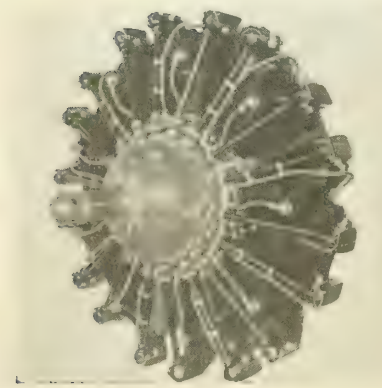
**Accessories.** General Electric supercharger, Scintilla magnetos, Stromberg carburetor, BG spark plugs, Thompson and Rich valves, Breeze radio shielding.



## WRIGHT Cyclone F Series — Geared — *ATC

R1820 geared models in this series GR-F1, GR-F2, GR-F3, GR-F11, GR-F31, GR-F32, GR-F33 and GR-F21. *ATCs (respectively) 89, 98, 103, 97, 101, 135, 118, and 93. Ratings Dept of Commerce and manufacturer's (latter indicated in brackets). Except noted other wise compression ratio 6.4:1, fuel rating 87; propeller shaft ratio 16.11.

**Specifications.** Length 47.82"; diameter 53.75". GR-F1 rated 700 h.p. at 1950 r.p.m.; blower gear ratio 5.95:1; weight 1042 lbs., or 1.49 lbs./h.p. GR-F2 rated 750 h.p. at 1950 r.p.m. at 2500 ft.; blower gear 7:1; weight 1050 lbs., or 1.40 lbs./h.p. GR-F3 rated 710 (697) h.p. at 1950 r.p.m. at 7000 (7400) ft.; blower gear 8.31:1; weight 1050 lbs., or 1.51 lbs./h.p. at 7000 ft. GR-F11 rated 690 (673) h.p. at 1950 r.p.m.; blower gear 5.95:1; compression ratio 5.75:1; weight 1042 lbs., or 1.55 lbs./h.p.; 80 octane fuel. GR-F31 rated 670 (663) h.p. at 1900 (1950) ft. at 2500 (1800) ft.; blower gear 5.95:1; weight 1042 lbs., or 1.57 lbs./h.p. at 2500 ft.; 80 octane fuel. GR-F32 rated 650 (658) h.p. at 1950 r.p.m. at 6500 (6300) ft.; blower gear 7:1; weight 1050 lbs., or 1.59 lbs./h.p. at 6300 ft.; 80 octane fuel. GR-F33 rated 635 (639) h.p. at 1950 r.p.m. at 9500 (9800) ft.; blower gear 8.31:1; weight 1050 lbs., or 1.64 lbs./h.p. at 9800 ft.; 80 octane fuel. GR-F21 rated 660 (644) h.p. at 1950 r.p.m.; compression ratio 5.3:1; blower gear 5.95:1; weight 1042 lbs., or 1.62 lbs./h.p.; 73 octane fuel.



## WRIGHT Cyclone F Series — Direct Drive — *ATC

R1820 direct drive models in this series, F-1, F-2, F-3, F-11, F-31, F-32, F-33 and F-21. *Approved type certificates respectively 89, 98, 103, 97, 101, 135, 118 and 93. Ratings given are Dept. of Commerce and manufacturer's (latter indicated in brackets). Compression ratio on these engines, except noted otherwise, 6.4:1.

**Specifications.** Length 43.37"; diameter 53.75". F-1 rated 715 h.p. at 1950 r.p.m.; blower gear ratio 5.95:1; weight 947 lbs., or 1.32 lbs./h.p.; 87 octane fuel. F-2 rated 770 (768) h.p. at 1950 r.p.m. at 2600 ft.; blower gear 7:1; weight 955 lbs., or 1.24 lbs./h.p. at 2600 ft.; 87 octane fuel. F-3 rated 710 (715) h.p. at 1950 r.p.m. at 7000 (7400) ft.; blower gear 8.31:1; weight 955 lbs., or 1.33 lbs./h.p. at 7400 ft.; 87 octane fuel. F-11 rated 690 h.p. at 1950 r.p.m.; compression ratio 5.75:1; blower gear 5.95:1; weight 947 lbs., or 1.37 lbs./h.p.; 80 octane fuel. F-31 rated 670 (680) h.p. at 1900 (1950) r.p.m. at 2500 (1800) ft.; blower gear 5.95:1; weight 947 lbs., or 1.39 lbs./h.p. at 1800 ft.; 80 octane fuel. F-32 rated 675 h.p. at 1950 r.p.m. at 6500 (6300) ft.; blower gear 7:1; weight 955 lbs., or 1.41 lbs./h.p. at 6300 ft.; 80 octane fuel. F-33 rated 650 (655) h.p. at 1950 r.p.m. at 9500 (9800) ft.; blower gear 8.31:1; weight 955 lbs., or 1.46 lbs./h.p. at 9800 ft.; 80 octane fuel. F-21 rated 660 h.p. at 1950 r.p.m.; compression ratio 5.3:1; blower gear 5.95:1; weight 947 lbs., or 1.44 lbs./h.p.; 73 octane fuel.

## WRIGHT Cyclone F-50 Series — 9-cylinder—radial — ATC

The Cyclone F50 series consists of four direct drive and four geared models all 9-cylinder radial, air-cooled. Lubricated by dry sump pressure feed method. Bore 6.12″; stroke 6.87″; displacement 1823 cu. in.; fuel consumption at cruising h.p. .45 lb./b.h.p./hr.; oil consumption .025 lb./b.h.p./hr. Basic construction practically similar in other respects.

**Construction.** Crankcase consists of nose, main, mounting, supercharger and accessory sections; nose section aluminum alloy forging which encloses cam and carries valve tappets, their guides and oil passages and control valve for operation of controllable-pitch propeller; main section forged aluminum alloy, two symmetrical parts joined at centerline of cylinders by bolts; cam drive gears located in forward part of main section; mounting section heat treated aluminum alloy casting which forms front wall of supercharger diffuser and distribution chamber and carries tangential ports for intake pipes; improved supercharger section attaches to rear mounting section; accessory section magnesium alloy forms the rear crankcase cover. Crankshaft chrome nickel steel forging, single throw supported on three bearings; equipped with dynamic damper. Cylinder heads aluminum alloy screwed and shrunk onto alloy steel barrels and fitted with pressure baffles; rocker support boxes cast integral, deep cooling fins; exhaust and intake ports at rear of head, former provided with four studs. Cylinder barrels alloy steel forgings, machined and threads on upper end for attachment to head; cylinder cooling augmented by system of inter-cylinder and inter-rocker box air deflectors; lugs on rocker box support boxes provide for attachment of ring or other low-drag cowls. Pistons aluminum alloy forgings, cross-ribbed on underside of head; piston pins alloy steel, full floating type; three compression, two oil and one scraper ring to each cylinder. Connecting rods forged alloy steel, I section; one piece master rod, eight link rods; crankpin bearing high lead bronze, steel backed shrunk and pinned into big end of master rod; piston pin and knuckle pin bushings bronze. Valve gear lubricated by automatic pressure system.

**Accessories.** G.E supercharger, Scintilla magnetos, Stromberg carburetor, BG spark plugs, Thompson and Rich valves, Breeze radio shielding.

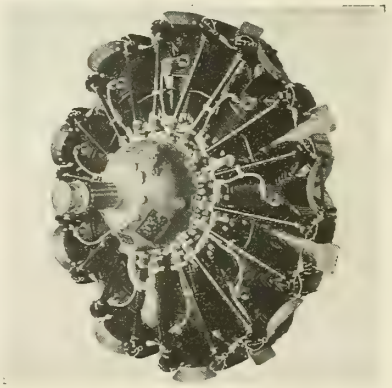
## WRIGHT Cyclone F-50 Series — Geared — *ATC



R1820 geared engines in this series GR-F52, GR-F53 and GR-F54 and GR-F56. *ATCs respectively 148, 149, 150, and 159. Ratings given are Department of Commerce and manufacturer's. Weights, at 1070 lbs. for each model, include two magnetos, carburetor, propeller hub cones and nut, baffles, exhaust stack flanges, generator, fuel pump, vacuum pump and tachometer drives, automatic valve gear lubrication, and hydro controllable propeller adaption. Compression ratio is 6.40:1; propeller shaft ratio 16:11; and fuel consumption is .64 lbs./b.h.p./hr., except noted otherwise. 87 octane fuel on all models.

**Specifications.** Length 47.81″; diameter 54.12″. GR-F52 rated 760 h.p. at 2100 r.p.m. at 5800 ft.; cruising rating 450-550 h.p. at 1850-1900 r.p.m.; power available for take-off 875 h.p. at 2200 r.p.m. at 39″ Hg. manifold pressure; blower gear ratio 7:1; weight in lbs./h.p. at 5800 ft., 1.39. GR-F-53 rated 730 h.p. at 2100 r.p.m. at 9600 ft.; cruising rating 450-550 h.p. at 1850-1900 r.p.m.; power available for take-off 770 h.p. at 2200 at 37.5″ Hg. manifold pressure; blower gear ratio 8.31:1; weight in lbs./h.p. 1.45 at 9600 ft. GR-F54 rated 675 h.p. at 2100 r.p.m. at 15,300 ft.; cruising rating 450-550 h.p. at 1850-1900 r.p.m.; power available for take-off 640-h.p. at 2100 r.p.m. at 35.5″ Hg. manifold pressure; blower gear ratio 10:1; weight in lbs./h.p. at 15,300 ft. 1.57; GR-F56 rated 740 h.p. at 2100 r.p.m. at 11,300 ft.; take-off power available 770 at 2200 r.p.m.

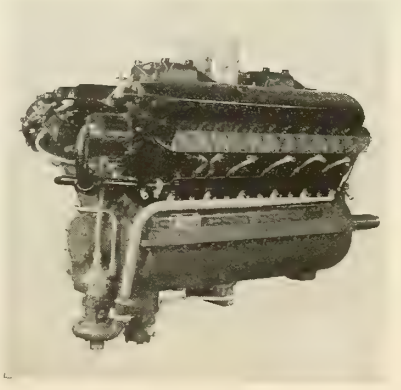
## WRIGHT Cyclone F-50 Series — Direct Drive — *ATC



R1820 direct drive models in this series, F-52, F-53, F-54 and F-56. *ATCs respectively 148, 149, 150 and 159. Ratings given are Dept. of Commerce and manufacturer's. Weights at 975 lbs. for each model, include 2 magnetos, carburetor, propeller hub cones and nut, baffles, exhaust stack flanges, generator, fuel pump, vacuum, tachometer drives, automatic valve gear lubrication, and hydro controllable propeller adaption. Compression ratio 6.40:1; 87 octane fuel is required.

**Specifications.** Length 43.37″; diameter 54.12″. F-52 rated 775 h.p. at 2100 r.p.m. at 5800 ft.; cruising rating 450-550 h.p. at 1850-1900 r.p.m.; power available for take-off 890 h.p. at 2200 r.p.m. at 39″ Hg. manifold pressure; blower gear ratio 7:1; weight in lbs./h.p. at 5800 ft. 1.25. F-53 rated 745 h.p. at 2100 r.p.m. at 9600 ft.; cruising rating 450-550 h.p. at 1850-1900 r.p.m.; power available for take-off 785 h.p. at 2200 r.p.m. at 37.5″ Hg. manifold pressure; blower gear ratio 8.31:1; weight in lbs./h.p. at 9600 ft., 1.30. F-54 rated 690 horsepower at 2100 revolutions per minute at 15,300 feet; cruising rating 450-550 horsepower at 1850-1900 revolutions per minute; power available for take-off 655 horsepower at 2100 revolutions per minute at 35.5″ Hg. manifold pressure; blower gear ratio 10:1; weight in pounds per horsepower at 15,300 feet, 1.40; fuel consumption at rated h.p. .64 lb./b.h.p./hr. F-56 rated 755 horsepower at 2100 r.p.m. at 11,300 ft.; take-off power 785 at 2200.

## CURTISS Conqueror — 12-cylinder—Vee — ATCs7-131



Models GV1570F-1 and GV1570F-2 (data on latter indicated in brackets).

**Specifications.** Geared, liquid-cooled. Dept. of Commerce rating 655 (675) h.p. at 2450 r.p.m.; power available for take-off 655 h.p. (675) at 2450 r.p.m. Compression ratio 6.5:1 (7.25:1). Propeller shaft ratio 2:1 or 7:5 (7:5). Bore 5.12″; stroke 6.25″; displacement 1587 cu. in. Length 68.84″; height 39.25″; width 26.56″. Weight (with magneto, carburetors, propeller hub cones and nut, coolant pump and pipes exhaust stack flanges tachometer, fuel pump, vacuum pump and generator drives and provision for hydro controllable pitch propeller) 995 (1000) lbs. or 1.52 (1.48) lbs./h.p. Fuel consumption .54 (.52) lb./b.h.p./hr. Oil consumption .025 lb./b.h.p./hr. 80 (87) octane fuel.

**Construction.** Crankcase aluminum alloy casting. Crankshaft chrome nickel molybdenum steel forging. Cylinder heads cast aluminum alloy jacket. Cylinders forged chrome molybdenum steel barrel with cast aluminum alloy jacket. Pistons forged aluminum alloy, with two compression and four oil piston rings to each cylinder. Connecting rods nickel steel forgings. Bearings copper lead and bronze for crankshaft and connecting rods, respectively; babbitt for propeller shaft; ball bearings for accessory drives.

**Accessories.** Scintilla magneto, Stromberg carburetors, BG spark plugs, Thompson and Rich valves.

# INDEX TO MANUFACTURERS OF ACCESSORIES AND PARTS

***The following pages contain a directory of the sources of supply of accessories and special parts for aircraft and aircraft engines. The listings are as complete as can be made with the information available. The accompanying Index indicates the manufacturers listed. Complete data relating to the companies is given in the Directory Section (pages 147 to 154) where manufacturers are listed alphabetically. Companies marked (Ja) are also listed in the January "Digest of Aircraft and Engine Machinery"; those marked (Ju) are also listed in the June "Digest of Aircraft and Engine Materials"; and those marked (Oct) are also listed in the October "Digest of Airport and Airline Equipment."***

**AIRCRAFT ARMAMENT**
Aerial Machine & Tool Corp.
Aero Supply Mfg. Corp.
Breeze Corporations, Inc.
Gaertner Scientific Corp.

**BATTERIES**
Burgess Battery Company
Electric Storage Battery Co.
Gould Storage Battery Company
Philadelphia Storage Battery Co.
Prest-O-Lite Battery Co.
Reading Batteries, Inc.
Willard Storage Battery Co.

**BEARINGS**
Aluminum Industries, Inc.
Amer. Non Gran Bronze Corp.
Amplex Div., Chrysler Corp.
Bantam Ball Bearing Company
Berium Bearings, Inc.
Bound Brook Oilless Bearing Co.
Bunting Bearing & Bronze Co.
The Fafnir Bearing Company
Federal Bearings Company
Federal-Mogul Corporation
Fischer Ball Bearing Corp.
Gwilliam Company
Hyatt Roller Bearing Co.
Marlin-Rockwell Corp.
New Departure Mfg. Co.
Norma-Hoffmann Bearing Corp.
SKF Industries, Inc.
Timken Roller Bearing Co.
Westinghouse Elec. & Mfg. Co.

**BOMB RACKS**
Aerial Machine & Tool Corp.
Aero Supply Mfg. Corp.
Apex Machine & Tool Co.
Diamond Chain & Mfg. Co.
Gaertner Scientific Corp.

**CAMERAS (Aerial)**
Fairchild Aerial Camera Corp.
Folmer Graflex Corporation
Skyview Aerial Camera Corp.

**CARBURETORS**
Bendix-Stromberg Carb. Corp.
Chandler-Groves Co.

**COLLECTOR RINGS, COWLS, STREAMLINES**
Aircraft Accessories, Inc.
Aircraft Development Co.
American Tube Bending Co., Inc.
Apex Machine & Tool Company
Baum, Seymour J.
Brewster Aeronautical Corp.
Buhl Stamping Company
Curtiss Aeroplane & Motor Co.
Engel Aircraft Specialties
General Sheet Metal & Wldg. Co.
Hill Aircraft Streamliners Co.
Magosy & Buscher
Solar Aircraft Company
Teicher Manufacturing Corp.
United Aircraft Products, Inc.

**CONTROLS**
Aero Supply Mfg. Corp.
Arens Controls
Breeze Corporations, Inc.
Cannon Electric Dev. Co.
Eclipse Aviation Corp.
Richland Auto Parts Co., Inc.
Shakespeare Products Company
United Aircraft Products, Inc.

**CONTROL STICKS & WHEELS**
American Hard Rubber Company
Bloxham Aero Mfg. Co.

**DE-ICER EQUIPMENT**
B. F. Goodrich Company
Eclipse Aviation Corporation

**DYNAMOTORS**
Eclipse Aviation Corporation
Electric Specialty Company
Pioneer Gen-E-Motor Corp.
Westinghouse Elec. & Mfg. Co.

**ELECTRICAL EQUIPMENT**
Adams & Westlake Co.
Bull Dog Electric Products Co.
Bussman Company
Cannon Electric Development Co.
Cutler-Hammer, Inc.
Electric Specialty Company
General Cable Corporation
General Electric Company
Leece-Neville Company
Littelfuse Laboratories
Scintilla Magneto Company
Simplex Electric Company
Struthers Dunn, Inc.
S. S. White Dental Mfg. Co.
Union Switch & Signal Company
United American Bosch Corp.
Westinghouse Elec. & Mfg. Co.

**Generators**
Air Associates, Inc.
Autonator Laboratories, Inc.
Eclipse Aviation Corporation
Electric Specialty Company
Electrical Development Corp.
General Electric Company
Heintz & Kaufman, Ltd.
Pump Engineering Service Corp.
Westinghouse Elec. & Mfg. Co.

**Magnetos**
Berling Magneto Company
Edison-Splitdorf Company
Scintilla Magneto Co., Inc.
United American Bosch Corp.

**Motors**
The Dumore Company
Eclipse Aviation Corporation
Electric Specialty Company
General Electric Company
Wagner Electric Corporation

**Switches**
Bull Dog Electric Products Co.
Cutler-Hammer, Inc.
Harvey Hubbell, Inc.
Pass & Seymour, Inc.
Pioneer Instrument Co., Inc.
Scintilla Magneto Co., Inc.

**FASTENERS**
Dzus Fastener Company
Parker-Kalon Corporation
United-Carr Fastener Corp.

**FILTERS (Air-Fuel-Oil)**
AC Spark Plug Company
Air-Maze Corporation
Cuno Engineering Corporation
Fostoria Pressed Steel Corp.
Motor Improvements, Inc.
Stewart-Warner Corporation

**FIRE EXTINGUISHERS**
Amer. LaFrance & Foamite
Badger Fire Extinguisher Co.
Buffalo Fire Appliance Corp.
Dayton Fire Extinguisher Co.
Firemaster Company
Flash Fire Extinguisher Co.
The Fyr-Fyter Company
Walter Kidde & Company, Inc.
Pyrene Manufacturing Co.
Robinson Fire Appar. Mfg. Co.
Stempel Fire Ext. Mfg. Co.

**FIRST AID EQUIPMENT**
Bauer & Black
E. D. Bullard Company
Burroughs-Wellcome & Co., Inc.
Davis Emergency Equipt. Co.
Johnson & Johnson
Seabury & Johnson

**FLARES**
International Flare Signal
Pioneer Instrument Co., Inc.

**FLOATS, SKIIS**
Baum, Seymour J.
Brewster Aeronautical Corp.
Edo Aircraft Corporation
Federal Aircraft Works, Inc.
Fleetwings, Inc.
Kammer Ski Company
Northwest Air Service, Inc.
Warner Aircraft Company

**INSTRUMENTS**
Abrams Instrument Co.
AC Spark Plug Company
Aero Instrument Company
Aeromarine Instrument Co., Inc.
Air Associates, Inc.
American Askania Corporation
American Paulin System
American Schaeffer & Budenberg
Barbour Stockwell Company
Bausch & Lomb Optical Company
Boston Auto Gauge Company
Cambridge Instrument Co., Inc.
Chelsea Clock Company
Eclipse Aviation Corporation
Electric Auto-Lite Co.
Electric Speed Indicator Co.
Elgin National Watch Co.
Fairchild Aerial Camera Corp.
Folmer Graflex Corp.
Foxboro Company
Frisbie Aircraft Products
General Electric Company
General Scientific Equipt. Co.
The Hays Corporation
Heintz & Kaufman, Ltd.
Jaeger Watch Company
Johnson Airplane & Supply Co.
Klemm Automotive Products Co.
Kollsmann Instrument Co., Inc.
Leeds & Northrup Company
Lewis Engineering Company
The Liquidometer Corporation
New Haven Clock Company
Pacific Scientific Company
Parker Appliance Company
Pioneer Instrument Co., Inc.
Reiker Instrument Company
E. S. Ritchie & Sons, Inc.
George Ruefel Company
Shore Instrument Company
Sperry Gyroscope Company
Star Compass Company
Steel Products Engineering Co.
Stewart-Warner Corporation
Taylor Instrument Companies
United Aircraft Products, Inc.
United States Gauge Company
Waltham Watch Company
Westinghouse Elec. & Mfg. Co.
Weston Electrical Instrument Co.
Weems System of Navigation
White Co., Kelvin & Wilfrid

**LANDING AND NAVIGATION LIGHTS**
Adams & Westlake Co.
Air Associates, Inc.
Corcoran-Brown Lamp Company
Grimes Manufacturing Co.
C. M. Hall Lamp Company
Pyle-National Company
S & M Lamp Company

**PARACHUTES**
Folmer, Clogg Company
Irving Air Chute Co., Inc.
Switlik Parachute & Equipt. Co.
Triangle Parachute Company

**PRIMERS**
The Lunkenheimer Co
Parker Appliance Company
Pump Engineering Service Corp.
United Aircraft Products, Inc.

**PROPELLERS & PROPELLER PARTS**
Aircraft Steel & Supply Co.
Aviation Manufacturing Corp.
Barkley-Grow Aircraft Corp.
California Propeller Company
Curtiss Aeroplane & Motor Corp.
Eclipse Aviation Corporation
Fay-Egan Manufacturing Co.
Fahlin Aircraft Company
Flottorp Propeller Company
Hamilton Standard Propellers
Hartzell Propeller Company
Heath Aviation Company
Marshall-Fahlin Propeller Co.
Mathews Brothers Mfg. Co.
McCauley Aviation Corp.
Maynard-DiCesare Propeller Co.
Pittsburgh Screw & Bolt Co.
Sensenich Brothers
Stone Propeller Company
Story-Gawley Company
Universal Aircraft Supply Co.

**PUMPS (Air, Fuel, Oil)**
AC Spark Plug Company
Aero Supply Mfg. Corp.
Eclipse Aviation Corporation
Evans Appliance Company
Heintz & Kaufman, Ltd.
Pioneer Instrument Co., Inc.
Pump Engineering Service Corp.
Stewart-Warner Corporation
Romec Pump Company
United Aircraft Products, Inc.

**RADIATORS**
G. & O. Manufacturing Company
Harrison Radiator Corporation
McCord Radiator & Mfg. Co.
United Aircraft Products, Inc.

**RADIOS**
Aeronautical Radio Company
Aircraft Radio Corporation
Bendix Radio Corporation
Harvey Radio Laboratory
Heintz & Kaufman, Ltd.
Lear Developments, Inc.
Philco Radio & Television
Radio Frequency Lab., Inc.
RCA Manufacturing Company
Simplex Electric Company
Western Electric Company
Westinghouse Elec. & Mfg. Co.
Zenith Radio Corporation

**RADIO COMPASSES**
Bendix Radio Corporation
Fairchild Aerial Camera Corp.
Fisher Research Lab.
Lear Developments, Inc.
RCA Manufacturing Company
Radio Navigational Inst. Co.
Ritchie & Sons, E. S.
Simplex Electric Company
Western Electric Company

**RADIO SHIELDING & EQUIPMENT**
Air Associates, Inc.
Aladdin Radio Industries, Inc.
Bendix Radio Corporation
Breeze Corporation
Brush Development Company
Cannon Electric Development Co.
Heintz & Kaufman, Ltd.
Hygrade Sylvania Corporation
Lear Developments, Inc.
RCA Manufacturing Company
Titeflex Metal Hose Company
Trimm Radio Manufacturing Co.
Universal Microphone Ltd.
Western Electric Company
Westinghouse Elec. & Mfg. Co.
Weston Electrical Instrument Co.
White, S. S. Dental Mfg. Co.

**RELIEF VALVES**
Aero Supply Mfg. Corp.
Pump Engineering Service Corp.
Romec Pump Company
United Aircraft Products, Inc.

**SAFETY BELTS**
Aerial Machine & Tool Corp.
Air Associates, Inc.
Russell Manufacturing Co.

**SHOCK STRUTS & CORD**
Bendix Aviation Corporation
Cleveland Pneumatic Tool Co.
Houde Engineering Corp.
Kirkham Eng. & Mfg. Corp.
Russell Manufacturing Co.
Warner Aircraft Co.

**SOUNDPROOFING SYSTEMS**
Burgess Battery Company
Sperry Gyroscope Company

**SPARK PLUGS**
AC Spark Plug Company
Aero Spark Plug Company
B. G. Corporation
Champion Spark Plug Company
Edison-Splitdorf Company
Scintilla Magneto Company, Inc.

**STARTERS**
Eclipse Aviation Corporation
Federal Laboratories, Inc.
Heintz & Kaufman, Ltd.

**SUPERCHARGERS**
General Electric Company

**TIRES & TUBES**
B. F. Goodrich Company
Firestone Tire & Rubber Co.
General Tire & Rubber Company
Goodyear Tire & Rubber Co.
United States Rubber Company

**VIBRATION DAMPERS**
Garlock Packing Company
General Tire & Rubber Co.
B. F. Goodrich Company
Lord Manufacturing Co.
United States Rubber Company

**WHEELS & BRAKES**
Aircraft Prod. Corp. of Amer.
Air Transport Equipment, Inc.
Bendix Aviation Corporation
Dayton Wire Wheel Company
Ebbert-Hatch Wheel Company
Goodyear Tire & Rubber Co.
Hayes Industries, Inc.
Kelsey-Hayes Wheel Company
Shinn Devices Corporation
Universal Alloy Products Co.
Variety Manufacturing Co.
Wagner Electric Corporation
Warner Aircraft Company
Welch Airplanes, Inc.

**MISCELLANEOUS**
Adams & Westlake Co.
(ash receptacles)
Bausch & Lomb Optical Co.
(binoculars; sextants)
P. & F. Corbin (locks)
Cowles Manufacturing Co.
(dome lights)
Dayton Mfg. Co.
(lavatory equipt.)
Fairchild Aerial Camera Corp.
(machine gun cameras)
Formica Insulation Co.
(controls)
General Cable Corporation
(moulded ignition manifolds)
Lunkenheimer Company
(fuel line fittings)
Northill Company, Inc.
(folding anchors)
The Pantosote Company, Inc.
(cockpit & engine covers)
A. Schrader's Son (air valves)
A. M. Stevens (locks)
Switlik Parachute & Equipt. Co.
(cockpit & engine covers)
Washington Inst. of Tech.
(blind landing systems)
Yale & Towne Mfg. Co. (locks)

# Manufacturers of Accessories and Parts

## A

**Abrams Instrument Co.**
**119 W. Allegan St., Lansing, Mich.**
T. Albert Abrams, pres.
Accessories:
Instruments (contour finders; air map distortion correctors; artificial horizons).

**AC Spark Plug Co., Flint, Mich.**
F. S. Kimmerling, pres.; T. G. McDougal, vice-pres.; W. S. Isherwood, gen. sales mgr.; C. W. McKinley, chief eng.
Accessories:
Spark plugs. Instruments (ammeters). Oil filters. Pumps (fuel; vacuum).

**The Adams & Westlake Company**
**Elkhart, Indiana**
W. W. Willits, pres.; W. A. Smith, vice-pres. & gen. mgr.; A. S. Anderson, vice-pres.; G. L. Walters, sec. & treas.
Branch offices:
319 W. Ontario St., Chicago; Hudson Terminal Bldg., N. Y. C.
Accessories:
Lights (landing; streamline running; anchor and identification; instrument board). Electric receptacles. Ash receptacles.

**Aerial Machine & Tool Corp.**
**260 West St., New York, N. Y.**
B. Kurz, sec.
Accessories:
Bomb racks. Bomb release devices. Bowdenite cable control housing. Gun sights. Safety belts. Drift sights. Instrument lights. Aircraft armament. (*Ju*).

**Aero Instrument Company**
**3678 W. 138 St., Cleveland, Ohio**
Emil Daiber, pres.
Accessories:
Instruments.

**Aero Spark Plug Co., Inc.**
**345 Hudson St., N. Y. C.**
A. A. Kasarjian, mgr. engineering, and manufacturing.
Accessories:
Spark plugs (mica insulated).

**Aero Supply Mfg. Co., Inc.**
**Corry, Pennsylvania**
F. N. Ames, pres.; S. J. Irvine, vice-pres. and gen. mgr.; L. E. Graham, vice-pres. and treas.; H. A. Krone, asst. gen. mgr.; J. R. Dunnihoo, chief eng.; A. F. Maish (Dayton).
Export representatives:
Curtiss-Wright Export Corp., Rockefeller Plaza, N. Y. C.; Aviation Equipment & Export, Inc., 25 Beaver St., N. Y. C.
Branch offices:
1101 E. 2 St., Dayton. Representative, Garrett Supply Co., 1126 S. Santa Fe Ave., Los Angeles.
Accessories:
Engine controls. Fuel pumps (hand and power driven). Valves (fuel; relief). Hardware. Strainers. Bomb release handles. Gun mount posts. (*Ju*).

**Aeromarine Instrument Co., Inc.**
**450 Whitlock Av., New York**
Adolf Urfer, pres. & treas.; G. Barrelet, sec.; B. Scarstrom, chief eng.
Branch offices:
5300 W. 63 St., Chicago; 1200 Airway, Glendale, Calif.
Accessories:
Instruments (altimeters; compasses; tachometers; airspeed, rate of climb, ice warning and ball bank indicators; engine gauge units; superchargers, temperature, oil pressure and fuel pressure gauges; clocks; pitot tubes; cabin thermometers).

**Aeronautical Radio Co.**
**Garden City, New York**
George W. McCauley, pres.
Accessories:
Radios (receivers).

**Air Associates, Inc.**
**Garden City, New York**
F. Leroy Hill, pres.; Haven B. Page, vice-pres.; H. I. Crow, sec.-treas.; Ray Acre (Chicago); Ted Lynn (Glendale).
Branch offices:
Chicago Municipal Airport; Grand Central Air Terminal, Glendale.
Accessories:
Instruments. Radio shielding. Generators. Navigation accessories. Safety belts. Aircraft hardware. Also distributors and exporters (*Ju; Oct*).

**Aircraft Accessories, Inc.**
**Keyport, New Jersey**
Lou Reichers, pres.; R. D. Smith, sec.-treas.
Accessories:
Tanks (fuel and oil). Exhaust collector rings. Engine mounts. Chrome molybdenum fittings. Aluminum alloy parts.

**Aircraft Development Co.**
**Washington, D. C.**
W. A. Driggers, pres. & sr. eng.; N. R. Cissel, vice-pres. & purchasing agent.
Accessories:
Streamlinings. Engine mounts. Tanks. Collector rings. Wings. Cockpit enclosures.

**Aircraft Prod. Corp. of America**
**7424 Melville Ave., Detroit, Mich.**
Accessories:
Wheels. Brakes.

**Aircraft Radio Corp.**
**Boonton, New Jersey**
Dr. L. M. Hull, pres.; Dr. F. H. Drake and P. O. Farnham, vice-pres.; B. E. Holley, treas.
Accessories:
Radios (receivers).

**Aircraft Steel & Supply Co.**
**528 W. Douglas, Wichita, Kan.**
Accessories:
Propellers (metal).

**Air-Maze Corp., Cleveland, Ohio**
A. E. Schaaf, pres.; G. M. Walton, vice-pres.; W. G. Heacock, sales mgr.; C. O. Brandes, export rep.
Accessories:
Air filters.

**Air Transport Equipment, Inc.**
**Garden City, New York**
Alex A. Pedu, pres.
Accessories:
Wheels. Skiis.

**Aladdin Radio Industries, Inc.,**
**466 W. Superior St., Chicago, Ill.**
J. C. McGinley, vice-pres. & gen. mgr.; H. H. Burtt, sales dept.; F. N. Jacob, eng. dept.
Accessories:
Radio equipment (antenna; r-f and intermediate frequency transformers for radio receivers).

**Aluminum Industries, Incorporated**
**Cincinnati, Ohio**
H. J. Hater, vice-pres. & gen. mgr.; J. P. Andrae, vice-pres. in charge aviation sales; M. A. Beckmann, chief eng. District sales engineers: B. J. Plumley (Detroit); N. R. Patterson (Chicago).
Factory:
2416-2438 Beekman St., Cincinnati.
Branch offices:
Fisher Bldg., Detroit; 616 S. Michigan Ave., Chicago.
Accessories:
*Permite* aluminum alloy pistons. Piston pins. Valves (diachrome and steel). Torque pins. Aluminum hinge bearings. (*Ju*.)

**American Askania Corp.**
**Chicago, Ill.**
G. Stubbe, vice-pres.
Branch offices:
M & M Bldg., Houston, Tex.
Accessories:
Instruments.

**American Hard Rubber Co.**
**11 Mercer St., New York, N. Y.**
Accessories:
Control sticks. Wheels. (*Ju*.)
(*Continued on following page*)

(*Continued from preceding page*)

**American-LaFrance & Foamite Ind.**
**Elmira, New York**

W. J. Childs, pres.; O. M. Canter, vice-pres., sec. & treas.; E. E. O'Neill, vice pres. & gen. sales mgr.; A. G. Sullivan, asst. gen. sales mgr.

Branch offices:
181 Spring St., N. W., Atlanta; 28 Brighton Ave., Boston; 445 N. Lake Shore Dr., Chicago; 1415 W. 9 St., Cleveland; 2403 S. Harwood St., Dallas; 1741-43 Arapahoe St., Denver; 4823 Woodward Ave., Detroit; 100 E. LaFrance St., Elmira; M & M Bldg., Houston; 1621 McGee St., Kansas City, Mo.; 733-739 E. 8th St., Los Angeles; 250 W. 57 St., New York; 401 N. Broad St., Philadelphia; 318 Penn Ave., Pittsburgh; 408 N. W. 12 St., Portland, Ore.; 430 Ninth St., San Francisco; 78 Jackson St., Seattle; 230 N. Division St., Spokane; 1343 H St., N. W., Washington, D. C.; 569 S. Broadway, Yonkers, N. Y.

Accessories:
Fire extinguishers [*Foamite;* Alfite (hand; portable)]. Fire guns (vaporizing liquid). *Alfite* aircraft engine fire extinguishing systems. (*Oct.*)

**American Non Gran Bronze Corp.**
**Berwyn, Pennsylvania**

P. E. Guckes.

Accessories:
Bearings (*Ju.*)

**American Paulin System**
**Los Angeles, California**

Accessories:
Instruments (barometers); altimeters; level flight indicators. (*Oct.*)

**American Schaeffer & Budenberg**
**Bridgeport, Connecticut**

R. R. Wason, pres.; W. P. Bradbury, vice-pres. in charge sales; E. F. Nordstrom, sales mgr., instrument div.; E. H. Hammond, chief eng.; W. G. Leiser, export mgr.

Branch offices:
Chrysler Bldg., N. Y. C.; Field Bldg., Chicago; 2318 E. 8 St., Los Angeles; Gulf Bldg., Pittsburgh; Mayo Bldg., Tulsa, Okla.; Ponce de Leon Hotel, Kansas City, Mo.; 3200 Broad St., Philadelphia.

Accessories:
Instruments (engine gauge unit; free air stout thermometer; dial thermometer; fuel and oil pressure gauges; remote reading thermometer).

**American Tube Bending Co., Inc.**
**New Haven, Connecticut**

H. W. Jones, Jr., pres.; E. L. Wulf, secy.; J. L. Umsteadt, supt.

Accessories:
Exhaust collectors. Exhaust stacks. Intake pipes. Oil lines. Engine mounts. Tail skids. (*Ju.*)

**Amplex Div., Chrysler Corp.**
**Detroit, Michigan**

A. J. Langhammer, A. H. Merschel, F. S. Keahey, G. E. Platzer, aeronautical div.

Accessories:
Bearings (bronze; oilless; self-lubricating).

**Apex Machine & Tool Co.**
**Dayton, Ohio**

C. A. Lange, pres.

Accessories:
Landing gears. Bomb rack releasing mechanisms. Engine cowl shutter controls. Universal joints for aircraft controls. (*Ju.*)

**Arens Controls, Chicago, Ill.**

Charles A. Arens, pres.

Accessories:
Remote controls (rigid; flexible). Vernier and locking type units.

**Autonator Laboratories, Inc.**
**8440 S. Chicago Ave., Chicago, Ill.**

Accessories:
Electrical generators.

**Aviation Manufacturing Corp.**
**Lycoming-Smith Propeller Div.**
**Williamsport, Pennsylvania**

W. H. Beal, pres.; F. M. Bender, vice-pres. & gen. mgr.; Z. H. Whiteman, Jr., sales mgr.

Accessories:
Propellers [hollow steel; (*Smith* controllable-pitch)].

## B

**BG Corporation**
**136 W. 52 St., New York, N. Y.**

R. Goldsmith, pres.; G. M. Paulson, chief eng.; R. W. Leedom, sales mgr.; K. S. Lindsay, sales and service.

Branch offices:
Pacific Airmotive Corp., Ltd., Union Air Terminal, Burbank. (Distributor).

Accessories:
Spark plugs (mica insulated; shielded; unshielded).

**Badger Fire Extinguisher Co.**
**Boston, Massachusetts**

A. H. Blackett, pres.

Branch offices:
New York; Chicago; San Francisco.

Accessories:
Fire extinguishers. (*Oct.*)

**The Bantam Ball Bearing Co.**
**South Bend, Indiana**

F. W. Deming, pres.; A. H. Frauenthal, vice-pres. & gen. mgr.; R. B. Nichols, sales mgr.

Branch offices:
Detroit; Seattle; Milwaukee; Pittsburgh; Hartford; New Orleans; Rochester; Chicago; Toledo; Washington, D. C.; Cleveland; Philadelphia; Dayton.

Accessories:
Bearings (ball; roller; needle; quill). (*Ju.*)

**Barbour Stockwell Co.**
**Cambridge, Massachusetts**

Ernest F. Stockwell, pres. & gen. mgr.; E. T. Blanchard, sales eng.

Accessories:
Instruments; tachometers (*Reliance*). tachometer equipment (*Ju.*)

**Barkley-Grow Aircraft Corp.**
**Penobscot Bldg., Detroit, Mich.**

Com. H. B. Grow, pres. & gen. mgr.; A. S. Barkley, vice-pres. & prod. mgr.; R. R. Stoetzer, sec. & treas.; D. C. Maier, chief eng.

Accessories:
Propellers (steel) *Supreme.*

**Bauer & Black, Chicago, Ill.**

R. A. Whidden, pres.; C. K. Perkins, vice-pres. & gen. sales mgr.; H. B. Crow, sales mgr.; J. R. Strohecker, asst. gen. sales mgr.

Accessories:
First aid kits. (*Oct.*)

**Seymour J. Baum**
**49 Mill St., Astoria, N. Y.**

Accessories:
Floats. Skiis. Streamlinings.

**Bausch & Lomb Optical Co.**
**Rochester, New York**

I. L. Nixon, mgr. scientific instrument sales div.; Roy G. Walker, mgr. aircraft instrument dept. (Rochester). Managers—L. I. Withington (Chicago), E. H. Anthes (New York). Haller Belt (San Francisco). Representatives—P. W. Hayes (Boston), F. R. Abbot (Los Angeles), J. I. Wexlin (Philadelphia), F. H. Gaither (Washington).

Branch offices:
Kesner Bldg., Chicago; R. C. A. Bldg., N. Y. C.; 593 Market St., San Francisco; 131 Clarendon St., Boston; 542 S. Broadway, Los Angeles; 1700 Walnut St., Philadelphia; 1324 Eye St., N. W., Washington, D. C.

Accessories:
Optical instruments (microscopes; protractors; metallographic equipment). Binoculars. Sextants. (*Oct.*)

**Bendix Aviation Corporation**
**South Bend, Indiana**

Vincent Bendix, pres.; W. J. Buettner, vice-pres. & treas.; J. R. Cautley, sales mgr., airplane wheel and brake div.

Accessories:
Shock struts. Wheels. Brakes. Tail wheel assemblies. Pilots' seats.

**Bendix Radio Corp.**
**Washington, D. C.**

Vincent Bendix, pres.; L. A. Hyland, vice-pres. & gen. mgr.; R. T. Hurley and W. P. Hilliard, vice-presidents; C. E. Mead, vice-pres. & works mgr.; W. J. Buettner, treas.; H. Gossner, sec.

Factories:
Chicago; Dayton; Washington; Oakland.

Accessories:
Radio (transmitters; receivers; accessories). Radio compasses. Blind landing systems.

**Bendix Stromberg Carburetor Corp.**
**South Bend, Indiana**

Accessories:
Carburetors.

**Berium Metals Corp.**
**258 State St., Rochester, N. Y.**

Accessories:
Bearings. (*Ju.*)

**Berling Magneto Co.**
**Buffalo, N. Y.**

Accessories:
Magnetos.

**Bloxham Aero Mfg. Co.**
**7541 Emerald Ave., Chicago, Ill.**

Accessories:
Control sticks and wheels. (*Ju.*)

**Boston Auto Gage Co.**
**28 Clapp Ave., Pittsfield, Mass.**

Thomas C. Nelson.

Accessories:
Instruments.

**Bound Brook Oilless Bearing Co.**
**Bound Brook, New Jersey**

Accessories:
Bearings.

**Breeze Corporations, Inc.**
**Newark, New Jersey**

J. J. Mascuch, pres.; A. L. Johnson, Jr., vice-pres.; J. F. Lucas, sales mgr.; S. H. Roberts, prod. mgr.; F. G. Gardner and M. M. Eells, aircraft engineers.

Accessories:
Conduits (flexible shielded; assemblies). Fittings (fuel and oil line). Tab control assemblies. Shielding (radio ignition). Hardware. Ammunition round counters. Flexible tubing. (*Ja., Ju.*)

**Brewster Aeronautical Corp.**
**Long Island City, New York**

James Work, pres.; R. M. Singer and R. D. Work, Jr., vice-presidents; P. M. Stephenson, works mgr.; D. T. Brown, chief eng.

Accessories:
Aluminum alloy products (exhaust manifolds, hot spot assemblies; engine ring cowls; cylinder head deflectors; firewalls; pilot's seats; radio tables; ammunition boxes; flotation gear containers; fuel and oil tanks). Wing cellules (struts; wires). Tail surfaces and struts. Landing gears including floats; wing tip floats; struts. (*Ju.*)

**Brush Development Co.**
**1892 E. 40th St., Cleveland, Ohio**

Accessories:
Radio accessories (headphones).

**Buffalo Fire Appliance Corp.**
**44 Central Ave., Buffalo, N. Y.**

D. Meidel, sundry sales mgr.

Accessories:
Fire extinguishers. (*Oct.*)

**Buhl Stamping Co.**
**Detroit, Michigan**

N. F. McCarthy, sales eng.

Accessories:
Exhaust manifolds. Air ducts. Nose cowl assemblies. Cowl rings. (*Ju.*)

**Bull Dog Electric Products Co.**
**Detroit, Michigan**

Accessories:
Switches (starting; battery; momentary-contact; disconnect) (*Oct.*)

**E. D. Bullard Company**
**San Francisco, California**

Alpheus Bullard (San Francisco); F. R. Penney (Los Angeles); J. J. Coombs (Salt Lake City); J. J. Delahide (Houston); G. M. Glidden (Chicago).

Branch offices:
275 Eighth St., San Francisco; 1229 S. Olive St., Los Angeles; 1620 Yalecrest Ave., Salt Lake City, Utah; 1 Main St., Houston; 215 S. Leavitt St., Chicago; 1775 Broadway, N. Y. C.

Accessories:
First aid kits. Sirens. (*Oct.*)

**Bunting Bearing & Bronze Co.**
**Toledo, Ohio**

C. E. Bunting, pres.; J. W. Bunting and W. H. Bunting, vice-pres.; D. McKercher, exec. vice-pres.; G. H. Adams, director of sales; R. G. N. Evans, eng. in charge research; E. N. Beisheim, export mgr.

Branch offices:
312 Ivy St., N. E., Atlanta; 106 Brookline Ave., Boston; 565 Bushwick Ave., Brooklyn, N. Y.; 2618 S. Michigan Ave., Chicago; 717 Sycamore St., Cincinnati; 1250 Ontario St., Cleveland; 447 E. Fort St., Detroit; 3690 Sante Fe Ave., Los Angeles; 612 W. Michigan St., Milwaukee; 419 Plane St., Newark; 1640 Fairmount Ave., Philadelphia; 565 Howard St., San Francisco; 270 Lafayette St., N. Y. C.; 3157 Locust Blvd., St. Louis.

Accessories:
Bushing bearings (cast bronze sleeve-type; machined and centered bronze bars; anti-friction industrial babbitt; graphited bronze oilless) (*Ju.*)

**Burgess Battery Co.**
**Freeport, Illinois**

G. F. Burgess, pres.; B. S. Reybolds and Jackson Burgess, vice-pres.; E. A. Sipp. sales mgr.

Export representatives:
Burgess Battery Co., 202 E. 44 St., N. Y. C.

Factories:
Madison, Wisc.; Freeport, Ill.; Niagara Falls, Ont., Canada.

Branch offices:
Chicago; New York; Boston; Atlanta; Detroit; Minneapolis; Kansas City, Mo.; San Francisco; Los Angeles; Montreal, Toronto, Winnipeg and Vancouver, Canada.

Accessories:
Dry batteries. Soundproofing systems.

**Burroughs-Wellcome & Co., Inc.**
**9 E. 41 St., New York, N. Y.**

Cecil R. Brown, sales director, first aid division.

Accessories:
First aid equipment (*Tabloid* aero kit; avion-kit; pocket-kit; pac-kits). (*Oct.*)

**Bussman Co., St. Louis, Mo.**

Branch offices:
Chicago; N. Y.-C.; Philadelphia.

Accessories:
Fuses. *Fusetrons.*

## C

**California Propeller Co.**
**Inglewood, California**

Arthur Fritzen, pres.

Accessories:
Propellers (wood).

**Cambridge Instrument Co., Inc.**
**Grand Central Terminal,**
**New York, N. Y.**

R. H. Kruse, pres. & gen. sales mgr.; H. M. Packard, vice-pres. & treas.; W. H. Jefferson, sec.

Accessories:
Instruments (air-fuel analyzers).

**Cannon Electric Development Co.**
**Los Angeles, California**

Representatives:
Lewis & Sachs Co., 220 Fifth Ave., N. Y. C.; Jenkins & Adair, Inc., 3333 Belmont Ave., Chicago; Public Address Systems, 7629 E. Jefferson, Detroit; Edward F. Aymond, 3750 Urban Ave., Dallas; James J. Backer Co., 109 Bell St., Seattle; Eastern Electric Engineering Co., 175 Hornby Rd., Bombay, India; National Societe Francaise, 27 Rue de Marignan, Paris, France.

Accessories:
Electrical equipment (cable connectors; antenna tuning units; remote control for airplane radio equipment; bomb-release solenoids).

**Champion Spark Plug Co.**
**Toledo, Ohio**

Duane Stranahan, mgr., aero. div.

Accessories:
Spark plugs (mica *coronaless;* ceramic; radio shielded).

**Chandler-Groves Co.,**
**Detroit, Michigan**
M. E. Chandler, pres.; W. B. Groves, vice-pres.; M. J. Kittler, eng.
Accessories:
Carburetors.

**Chelsea Clock Company**
**Boston, Massachusetts**
William H. Neagle.
Accessories:
Instruments (clocks).

**The Cleveland Pneumatic Tool Co.**
**3734 E. 78 St., Cleveland, Ohio**
L. W. Greve, pres.; F. H. Burr, mgr., Automotive-Aircraft Div.
Accessories:
Shock strut units (*Aerol*). (*Ja.; Oct.*)

**P. & F. Corbin**
**New Britain, Connecticut**
Branch offices:
New York; Chicago; Philadelphia.
Accessories:
Locks.

**Corcoran-Brown Lamp Co.**
**Cincinnati, Ohio**
Wm. L. Mappes, sales dept.
Accessories:
Lights (navigation; landing).

**Cowles Manufacturing Co.,**
**New Haven, Connecticut**
Accessories:
Dome lights.

**Cuno Engineering Corp.**
**Meriden, Connecticut**
C. H. Cuno, pres.; S. L. Wolfson, chief eng.; I. I. Hance, sales mgr.; D. H. Van Vleck, sales eng.
Accessories:
Oil filters.

**Curtiss-Wright Corporation**
**Curtiss Aeroplane Div.,**
**Buffalo, N. Y.**
Export representative:
Curtiss-Wright Corp., Export Sales Div., R. C. A. Bldg., N. Y. C.
Accessories:
Propellers (electrical controllable-pitch full-feathering; all-metal, single piece). Anti-drag rings.

**Cutler-Hammer, Inc.**
**Milwaukee, Wisconsin**
G. S. Crane, vice-pres. in charge of sales; H. B. Phillips, mgr., appliance sales; T. D. Montgomery, export sales mgr.
Branch offices:
201 Luckie St., N. W., Atlanta; 250 Stuart St., Boston; 295 Main St., Buffalo; 400 W. Madison St., Chicago; 920 E. McMillan St., Cincinnati; 1405 E. Sixth St., Cleveland; 2755 E. Grand Blvd., Detroit; 8 W. 40 St., New York; 132 Seventh St., Pittsburgh; 401 N. Broad St., Philadelphia; 1331 Santa Fe Ave., Los Angeles; 1914 Washington Ave., St. Louis; 2207 First Ave., S. Seattle; 970 Folsom St., San Francisco.
Accessories:
Toggle switches. Motor controls (safety switches, electric brakes, magnetic clutches, valve controls). (*Oct.*)

## D

**Davis Emergency Equipt. Co., Inc.**
**55 Van Dam St., New York, N. Y.**
Branch offices:
Buffalo; Chicago; Houston; San Francisco.
Accessories:
First aid equipment (*Oct.*)

**Dayton Fire Ext. Co., Dayton, Ohio**
Accessories:
Fire extinguishers. (*Oct.*)

**Dayton Mfg. Co., Dayton, Ohio**
Accessories:
Lavatory supplies.

**Dayton Wire Wheel Co.**
**Miami Chapple Rd., Dayton, Ohio**
Accessories:
Wheels. Brakes.

**Diamond Chain & Mfg. Co.**
**Indianapolis, Ind.**
W. A. Warrick and R. A. Schakel, in chg. aero. sales.
Branch offices:
Cleveland; New York; Philadelphia; Tulsa; Atlanta.
Accessories:
Bomb racks and bomb release devices. (*Ju.*)

**Dudley Lock Co., Chicago, Illinois**
A. M. Stevens.
Accessories:
Locks.

**The Dumore Co., Racine, Wisconsin**
L. J. LaMack, asst. sales mgr.; F. E. Broberg & S. E. Peters, elec. engineers; L. B. Augustine, sales mgr.; in ch. of tool div.; H. E. Nelson, tool design eng.
Branch offices:
100 Varick St., N. Y. C.
Accessories:
Motors (electrical). (*Jan.*)

**Dzus Fastener Company**
**Babylon, Long Island, N. Y.**
W. Dzus, pres.
Accessories:
Self-locking fasteners. (*Ju.*)

## E

**Ebbert-Hatch Wheel Co.**
**1631 Leslie St., Detroit, Mich.**
R. J. Ebbert, pres. & gen. mgr.; J. W. Hatch, vice-pres. in chg. eng. & sales; L. Briggs, factory mgr.
Accessories:
Wheels and brakes.

**Eclipse Aviation Corporation**
**East Orange, New Jersey**
Chas. Marcus, pres.; R. P. Lansing, vice-pres. & chief eng.; A. E. Raabe, sales mgr.
Accessories:
Starters (inertia; direct electric; air injection; hand turning gear; combustion; cartridge-type). Generators (single voltage; radio). Radio dynamotors. Air pumps. Mechanical deicer equipment. Propeller anti-icer pumps. Retracting motors (for floats; flap; landing gear). Flowmeters (remote; direct reading). Engine synchroscope. Hydraulic pumps. Hydraulic control equipment. Auxiliary gasoline engine power equipment. (*Ja.; Ju.; Oct.*)

**Edison-Splitdorf Co.,**
**W. Orange, N. J.**
Chas. Edison, pres.; A. J. Clark, vice-pres. & gen. mgr.; C. B. Cook, gen. sales mgr.
Accessories:
Spark plugs. Magnetos.

**Edo Aircraft Corporation**
**College Point, Long Island, N. Y.**
E. D. Osborn, pres.; G. B. Post, sales mgr.; B. V. Korvin-Kroukovsky, chief eng.; K. D. Vosler, factory supt.
Accessories:
Floats. Amphibious gears.

**The Electric Auto-Lite Co.**
**Moto Meter Gauge & Eqpt. Div.**
**Chrysler Bldg., New York, N. Y.**
Alfred Weiss, sales mgr., industrial div.
Accessories:
Instruments (ice-warning indicators; thermometers; oil pressure, fuel pressure, vacuum gauges; ammeters).

**Electric Speed Indicator Co.**
**14618 Bayes Ave., Lakewood, O.**
Accessories:
Instruments.

**Electric Storage Battery Co.**
**Philadelphia, Pennsylvania**
Accessories:
Storage batteries (*Exide*).

**Electric Specialty Company**
**Stamford, Connecticut**
J. M. Wright, pres.; M. L. Bickart, treas.; D. G. Shepherd, gen. mgr.; Wm. H. Haines, sales eng.
Export representatives:
Pan American Trading Co., 25 S. William St., N. Y. C.; International Products Co., 45 Ningpo Rd., Shanghai, China; Interamerican Aerotravel & Supplies, Inc., 420 Lexington Ave., N. Y. C.; Royal National Co., Inc., 16 W. 61 St., N. Y. C.
Accessories:
Generators (engine-driven; wind-driven). Electric motors. Gasoline engine generating sets. Dynamotors.

**Electrical Development Corp.**
**Los Angeles, California**
Accessories:
Generators.

**Elgin National Watch Co.**
**Elgin, Illinois**
Accessories:
Instruments (clocks).

**Engel Aircraft Specialties**
**Glendale, California**
John H. Engel, pres.
Accessories:
Streamlinings (speed rings; NACA cowlings; wheel pants, cowlings, spinners, tanks; exhaust rings. (*Ju.*)

**Evans Appliance Company**
**Detroit, Michigan**
E. S. Evans, pres.; E. S. Evans, Jr., vice-pres
Branch offices:
90 West St., N. Y. C. Representative—Pacific Airmotive Corp., Ltd., Union Air Terminal. Burbank.
Accessories:
Pumps (fuel). (*Ju.*)

## F

**The Fafnir Bearing Co.**
**New Britain, Connecticut**
Maurice Stanley, pres.; C. F. Stanley, vice-pres. in chg. sales; D. L. Holbrook, mgr., aircraft div.
Export representative:
R. A. Rodriguez, Fafnir Bearing Co., Bryant Park Bldg., N. Y. C.
Branch offices:
288 Spring St., Atlanta; 9 S. Clinton St., Chicago; Union Bldg., Cleveland; New Center Bldg., Detroit; 2825 Commerce St., Dallas; 1625 Grand Ave., Kansas City, Mo.; 1253 S. Flower St., Los Angeles; Circle Bldg., N. Y. C.; 3701 N. Broad St., Philadelphia; 1302 E. Pike St., Seattle.
Accessories:
Ball bearings for aircraft and engines. (*Ju.*)

**Fahlin Aircraft Co.**
**Marshall, Missouri**
Ole Fahlin, pres.
Accessories:
Propellers (wood).

**Fairchild Aerial Camera Corp.**
**Woodside, L. I., New York**
J. S. Ogsbury, pres.; F. W. Lutz, vice-pres. & gen. mgr.; W. H. Schwebel, sec.; E. Robinson, treas.
Accessories:
Aerial cameras (semi-automatic; fully automatic; multiple lens; tandem multiple lens). Machine gun cameras. Stereoscopes. Stereocomparagraphs. Camera equipment. Navigational equipment (radio compasses; position finders).

**Fay-Egan Mfg. Co., Cincinnati, O.**
S. M. Blackburn, pres.
Accessories:
Propellers (Wood).

**Federal Aircraft Works**
**Minneapolis, Minnesota**
J. A. Ditter, pres.; F. J. Ditter, eng. & prod. mgr.; A. A. Bursch, sales mgr.
Accessories:
Skis (all metal; composition wood and metal).

**The Federal Bearings Co., Inc.**
**Poughkeepsle, New York**
H. A. Schatz, pres.
Branch offices:
Book Tower, Detroit; 120 N. Peoria St., Chicago.
Accessories:
Bearings (ball). (*Ju.*)

**Federal Laboratories, Inc.**
**185 41 St., Pittsburgh, Pa.**
J. W. Young, pres.; R. B. Reynolds, vice-pres.; B. H. Barker, vice-pres.; H. E. Rau, treas.; Col. W. Mangum, chief, aero. dept.
Branch offices:
277 Broadway, N. Y. C.; 1010 Vermont Ave., N. W., Washington, D. C.
Accessories:
*Coffman* engine starters (cartridge type).

**Federal-Mogul Corp., Detroit, Mich.**
Branch offices:
210 Van Ness Ave., San Francisco; 1060 Broad St., Newark.
Accessories:
Bearings (steel back babbitt lined; steel back cadmium-silver-copper lined; bronze back babbitt lined; die cast). Bushings. Washers. (*Ju.*)

**Firestone Tire & Rubber Co.**
**Akron, Ohio**
J. W. Thomas, pres.; H. S. Firestone, Jr., vice-pres.; L. P. Jackson, vice-pres. in chg. of sales; H. R. Wilson, mgr. aero. sales.
Accessories:
Tires. Rubber accessories. (*Ju.*)

**Firemaster Co., New York, N. Y.**
Accessories:
Fire extinguishers.

**Fischer Ball Bearing Corp.**
**33 W. 60th St., New York, N. Y.**
A. Golden, sales mgr.
Accessories:
Bearings. (*Ju.*)

**Fisher Research Laboratories**
**Palo Alto, California**
Representatives:
Mouton & Six, Inc., San Francisco Airport, San Francisco.
Accessories:
Radio direction finders.

**Flash Fire Ext. Co., Dayton, O.**
Accessories:
Fire extinguishers.

**Fleetwings, Inc., Bristol, Pa.**
Charles F. deGanahl, chairman of the board; Carl deGanahl, pres.; W. L. Sutton, chief eng.
Accessories:
Stainless steel floats. (Also aircraft and parts).

**Flottorp Propeller Co.**
**Grand Rapids, Mich.**
Ole Flottorp, pres.
Accessories:
Propellers (wood).

**Folmer, Clogg Co., Lancaster, Pa.**
Accessories:
Parachutes.

**Folmer Graflex Corp.**
**Rochester, N. Y.**
G. C. Whitaker, vice-pres. in chg. aero. sales.
Accessories:
Aerial cameras and equipment. Inspection cameras (*Inspectograph*).

**The Formica Insulation Co.**
**Cincinnati, Ohio**
D. J. O'Connor, pres.; R. W. Lytle, eng. in ch. aviation; W. G. Steiner, adv. & sales mgr.
Factories:
Cincinnati; New York; Chicago.
Branch offices:
526 Forrest Ave., N. E., Atlanta; 1901 St. Paul., Baltimore; Brown-Marx Bldg., Birmingham; 111 N. Canal St., Chicago; Caxton Bldg., Cleveland; Santa Fe Bldg., Dallas; 960 Pearl St., Denver; Book Bldg., Detroit; 55 Calle Obispo, Havana, Cuba; 647 Main St., Hartford; P. O. Box 125, Houston; 1023 Lark St., Jacksonville; 308 E. 17 St., Kansas City, Mo.; 1437 E. 18 St., Los Angeles; 1449 N. W. First Ave., Miami; 145 Hudson St., N. Y. C.; Mason Bldg., Annex, New Orleans; Architects Bldg., Philadelphia; 405 Penn Ave., Pittsburgh; Granite Trust Bldg., Quincy, Mass.; Temple Bldg., Rochester, N. Y.; Interurban Depot, Salt Lake City; 90 Townsend St., San Francisco; Canadian National Pier, Seattle; 4497 Pershing Ave., St. Louis; Peninsular Telephone Bldg., Tampa; Second Nat'l. Bank Bldg., Toledo.
Accessories:
Control pulleys. Electric insulation panelling. (*Ju.*)

**The Fostoria Pressed Steel Corp.**
**Fostoria, Ohio**
C. D. Pifer, pres. & gen. mgr.; C. W. McDaniel, gen. sales mgr.; B. Zook, sales promotion mgr.
Accessories:
Coolant filters. *TiteSeal* sealing compound and gasket cement. (*Ja.*)

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**The Foxboro Co., Foxboro, Mass.**
E. H. Bristol, pres.; B. H. Bristol, vice-pres.; B. B. Bristol, treas.; C. E. Sullivan, sales mgr.; I. W. Reynolds, factory mgr.; E. S. Lawson, adv. mgr.
Accessories:
Instruments (airspeed indicators; thermometers; pressure gauges for oil and air).

**Frisbie Aircraft Products**
**New Haven, Connecticut**
M. H. Frisbie.
Accessories:
Instruments.

**The Fyr-Fyter Co., Dayton, Ohio**
R. C. Iddings, pres. & gen. mgr.; R. C. Hahn, gen. sales mgr.; K. D. Richardson, industrial sales mgr.
Accessories:
Fire extinguishers. (*Oct.*)

## G

**G & O Manufacturing Co.**
**New Haven, Connecticut**
A. J. Verdi, pres.; V. Carangelo, vice-pres.; C. Oppe, gen. mgr. & treas.
Accessories:
Engine cooling radiators. Oil temperature regulators and coolers.

**The Gaertner Scientific Corp.**
**Chicago, Illinois**
Wm. Gaertner, pres.; S. Jacobsohn, vice-pres.; R. A. Ackley, eng.
Accessories:
Bomb sights. Armament. Gun cameras. Instruments (precision measuring; optical).

**Garlock Packing Co., Palmyra, N. Y.**
District managers: S. E. Anderson (Palmyra); A. E. Munch, Jr. (N. Y. C.); H. J. Ramshaw (Chicago); L. P. Duggan (Philadelphia); F. E. Erlandson (St. Louis); F. L. Wallace (Boston); R. W. Perkins (Cleveland); Louis Mohn (Pittsburgh); E. A. Tolley (San Francisco); M. J. Lester (Denver); W. A. Redd, Jr. (Birmingham); C. W. Harmon (Los Angeles).
Accessories:
Vibration dampeners. (*Ju.*)

**General Cable Corp., N. Y., N. Y.**
Branch offices:
Healey Bldg., Atlanta; 89 Broad St., Boston; 56 Clyde Ave., Buffalo; 20 N. Wacker Dr., Chicago; 2637 Superior Ave., Cleveland; Interurban Bldg., Dallas; New Center Bldg., Detroit; 3600 E. Olympic Blvd., Los Angeles; 123 S. Broad St., Philadelphia; Koppers Bldg., Pittsburgh; 1000 Mill St., Rome, N. Y.; Ambassador Bldg., St. Louis; 30 Otis St., San Francisco; Smith Tower, Seattle; 730-15th St., N. W., Washington, D. C.
Accessories:
Wire and cable (combination landing light [shielded; unshielded]; ignition [high tension; low tension; shielded and unshielded]; lighting [shielded and unshielded]; moulded ignition manifold; magnet; radio antenna [copper; bronze]; starter; battery). (*Ju.; Oct.*)

**General Electric Co.**
**Schenectady, New York**
J. C. Miller, mgr.; E. G. Haven, H. C. Ritchie, aero division (Schenectady); T. B. Jacocks (Washington); C. E. Anthony (New York); R. B. Ranson (Hartford); R. E. Johnson (Los Angeles); J. Bosway (Dayton).
Factories:
Cleveland; West Lynn and Pittsfield, Mass.; Erie, Pa.; Fort Wayne; Bridgeport; Bloomfield, N. J.; Philadelphia; Oakland.
Branch offices:
In principal cities.
Accessories:
Superchargers. Instruments (tachometers; temperature and pressure indicators). Electric motors. Generators. Control equipment. (*Ja.; Oct.*)

**General Scientific Eqpt. Co.**
**N. Philadelphia, Pennsylvania**
Maurice Kline, pres.
Accessories:
Instrument (hydrometer syringes; gasoline hydrometers; motor thermometers.)

**General Sheet Metal & Wldg. Co.**
**Garden City, New York**
Accessories:
Collector rings. Cowls. Streamlinings.

**General Tire & Rubber Co.**
**Akron, Ohio**
Ray Brown, mgr. aero. sales.
Representatives:
Air Associates, Inc., Garden City, N. Y.; Chicago; Glendale; Bredouw-Hilliard Aeromotive Corp., Kansas City, Mo.
Accessories:
Tires and tubes (*Streamline*). (*Ju.*)

**B. F. Goodrich Co., Akron, Ohio**
T. A. Aspell, gen. sales mgr.; J. S. Pedler, sales mgr.
Accessories:
Tires and tubes (*Silvertown*). De-icers and abrasion shoes. (*Ju.*)

**Goodyear Tire & Rubber Co.**
**Akron, Ohio**
Paul Litchfield, pres.; L. O. Guinther, mgr. aviation sales; H. M. White, asst. mgr., aviation sales.
Accessories:
Tires. Tubes. Wheels (*Airwheels*). Brakes. (*Ju.*)

**Gould Storage Battery Co.**
**Depew, New York**
L. J. Shields, pres.; G. P. Castner, vice-pres.; J. L. Rupp, vice-pres. & gen. mgr.; J. C. Sykora, asst. sales mgr.
Accessories:
Storage batteries.

**Grimes Mfg. Co., Urbana, Ohio**
Accessories:
Position and navigation lights. Landing lights (fixed and retractable).

**The Gwilliam Company**
**360 Furman St., Brooklyn, N. Y.**
John Gwilliam, pres.
Accessories:
Bearings. (*Ju.*)

## H

**C. M. Hall Lamp Co., Detroit, Mich.**
W. F. Anklam, pres.; L. A. Wine, sales mgr.
Accessories:
Landing light assemblies.

**Hamilton Standard Propellers**
**(Div. United Aircraft Corp.)**
**East Hartford, Connecticut**
Raycroft Walsh, gen. mgr.; S. A. Stewart, asst. gen. mgr. & asst. sec.; Frank W. Caldwell, eng. mgr.; Erle Martin, chief eng.
Accessories:
Propellers (metal; [adjustable- and controllable-pitch]). Constant speed controls.

**Harrison Radiator Corp.**
**Lockport, New York**
C. P. Hart, asst. sales mgr.
Accessories:
Radiators (oil).

**Hartzell Propeller Co., Piqua, Ohio**
R. N. Hartzell, pres.; Mrs. G. W. Hartzell, vice-pres.; F. Charavay, chief eng.
Export representatives:
Air Associates, Inc., Garden City, L. I.; Curtiss-Wright Export Corp., R. C. A. Bldg., N. Y. C.; Fleet Aircraft of Canada, Ltd., Fort Erie, Ontario.
Accessories:
Propellers (wood). Propeller blades (metal).

**Harvey Hubbell, Inc.**
**Bridgeport, Connecticut**
E. K. Moore, sales mgr.
Accessories:
Switches (electrical).

**Harvey Radio Laboratory**
**Brookline, Massachusetts**
Accessories:
Radios.

**Hayes Industries, Inc.**
**Jackson, Michigan**
C. B. Hayes, pres. & gen. mgr.; C. Hollerith, vice-pres. in chg. of eng.
Branch office:
Garrett Supply Co., Los Angeles.
Accessories:
Landing wheels and brakes. Tail wheels.

**The Hays Corp.**
**Michigan City, Ind.**
Accessories:
Instruments (engine). Exhaust gas analyzer (*Orsat*).

**Heath Aviation Co.**
**Benton Harbor, Michigan**
H. E. Anthony, pres. & gen. mgr.; L. James, vice-pres.
Accessories:
Propellers (wood).

**Heintz and Kaufman, Ltd.**
**S. San Francisco, California**
R. M. Heintz, pres.; W. N. Eldred, sales eng.
Accessories:
Radio and radio equipment (transmitters; receivers; motor-driven antenna reels). Instruments (warning devices). Engine starters. Generators. Pumps (vacuum; oil).

**Hill Aircraft Streamliners**
**Cincinnati, Ohio**
J. A. Hill, pres. & gen. mgr.; W. A. Sundquist, factory mgr.
Accessories:
Streamlinings (NACA cowls; speed rings; engine nacelles; fairings; spinners). Fuel and oil tanks. (*Ju.*)

**Houde Engineering Corp.**
**Div. Houdaille-Hershey Corp.**
**537 E. Delavan Ave., Buffalo, N. Y.**
C. L. Barnes, pres.; R. F. Peo, vice-pres. & gen. mgr. (Detroit).
Accessories:
*Houdaille* hydraulic double acting shock absorbers.

**Hyatt Bearings Division**
**General Motors Corporation**
**Harrison, New Jersey**
Branch offices:
Detroit; Chicago; Pittsburgh; San Francisco.
Accessories:
Roller bearings. (*Ju.*)

**Hygrade Sylvania Corporation**
**Electronics Division**
**Clifton, New Jersey**
A. H. Hotopp, mgr. & chief eng.; W. E. Taylor, sales mgr.
Accessories:
Radio equipment (antenna reels, wire, fairleads; flame-proof transmitting keys).

## I

**International Flare-Signal Div.**
**Kilgore Manufacturing Company**
**Tippecanoe City, Ohio**
A. F. Hubbard, vice-pres.; L. L Driggs, Jr., chief eng.
Export representatives:
Imperial Chemical Industries, Ltd. Millbank, Westminster, S. W. 1 London, England; Miranda Bros., Inc., 6 E. 45 St., N. Y. C.; China Airmotive Co., 25 Beaver St., N. Y. C.
Accessories:
Flare and signal equipment. Pyrotechnics.

**Irving Air Chute Co., Inc.**
**Buffalo, New York**
G. Waite, pres.; L. L. Irvin, vice-pres. & chief eng.
Export representatives:
Irving Air Chute of Great Britain, Ltd., Letchworth, Herts, England and Fort Erie, Ontario, Canada.
Branch offices:
1500 Flower St., Glendale.
Accessories:
Parachutes. (*Irvin*).

## J

**Jaeger Watch Co., New York, N. Y.**
E. L. Vail, sec. & gen. mgr.
Accessories:
Instruments (clocks; chronographs; chronoflites; tachometers).

**Johnson Airplane & Supply Co.**
**Vandalia, Ohio**
Accessories:
Instruments. (*Oct.*)

**Johnson & Johnson**
**New Brunswick, New Jersey**
R. S. White, director, First Aid Div.
Accessories:
First aid kits and supplies. (*Oct.*)

## K

**Kammer Ski Co.**
**Wenatchee, Wash.**
W. Frank Kramer.
Accessories:
Skis.

**Kelsey-Hayes Wheel Co.**
**3600 Military Ave., Detroit, Mich.**
Accessories:
Wheels and brakes.

**Walter Kidde & Co., Inc.**
**140 Cedar St., New York, N. Y.**
Walter Kidde, pres.; W. Freygang, vice-pres.; managers, aero. div.: C. L. Griffin (N. Y. C.); S. G. Freck (Chicago); H. B. Teter (Cleveland); A. H. Hobelmann (Washington); R. V. Morris (San Diego).
Accessories:
Fire extinguishers (*Lux* systems). Fire detectors. Inflation systems for flotation equipment, life rafts and life vests. (*Oct.*)

**Kirkham Engineering & Mfg. Corp.**
**Farmingdale, New York**
Accessories:
Shock struts. (*Ju.*)

**Klemm Automotive Products Co.**
**Chicago, Illinois**
E. R. Klemm, Jr., pres.; C. E. Johnson, sales mgr.
Accessories:
Indicators (fuel and oil pressure).

**Kollsman Instrument Co., Inc.**
**1 Junius St., Brooklyn, N. Y.**
Branch office:
1224 Airway Drive, Glendale.
Accessories:
Instruments (accelerometers; airspeed indicators; altimeters [station meters; sensitive]; clocks; compasses [Army; Navy; aperiodic]; gages [fuel] quantity, fuel pressure, oil pressure] ice warning, level flight, vertical speed, speed and drift indicators; manifold pressure gages [sensitive; standard]; tachometers [magnetic, centrifugal, electric]; thermometers [oil, water, manifold, carburetor]; engine gage units; electrically heated pitot static tubes; *Telegon* remote indicating systems; self-contained rim lighting systems for all instruments).

## L

**Lear Developments, Inc.**
**121 W. 17 St., New York, N. Y.**
Wm. P. Lear, pres. & chief eng.
Accessories:
Radio (aircraft [transmitters; receivers]. Direction finding compasses. Radio equipment (automatic antenna reels; electric remote control stepmotors). (*Oct.*)

**Leece-Neville Co., Cleveland, Ohio**
B. M. Leece, pres.; F. H. Neville, vice-pres.; A. A. Skinner, sales & adv. mgr.
Accessories:
Electrical equipment. Generators.

**Leeds & Northrup Co.**
**4901 Stenton Ave., Philadelphia, Pa.**
M. E. Leeds, pres.; C. R. Cary, vice-pres. in chg. of sales; C. S. Redding, vice-pres. in chg. of engineering, research and patent departments; I. M. Stein, dir. of research; W. R. Schofield, chief. eng.
Branch offices:
N. Y. C.; Boston; Hartford; Cleveland; Detroit; Chicago; St. Louis; Tulsa; Houston; Los Angeles; San Francisco.
Accessories:
Instruments (precision apparatus for research and testing; temperature indicators; recorders; controllers). (*Ja.*)

**The Lewis Engineering Co.**
**Naugatuck, Connecticut**
Accessories:
Instruments (thermocouples; thermometers [engine cylinder; carburetor; strut type]; exhaust pyrometers; double-pole switches; potentiometers).

**The Liquidometer Corp.**
**Long Island City, New York**
C. A. deGiers, pres.
Accessories:
Fuel and pressure gauges (hydraulic;

electric). Electric indicator and selector switch units.

**Littlefuse Laboratories, Chicago, Ill.**
E. V. Sundt, gen. mgr.; B. Kollath, design eng.; L. J. Fohr, sales mgr.
**Export representatives:**
Stellio Tzoulakis & Co., 27, Boul. Saad Zaghloul, Alexandria, Egypt; D. Bercovitz & Sohn, Belziger Str. 61, Berlin-Schoneberg, Germany; A. F. Hulsewe, Keizersgracht, 188, Amsterdam, Holland; Johns Ltd., Chancery St., Auckland, N. Z.
**Accessories:**
Fuse and fuse clips. Neon indicators.

**Lord Manufacturing Co., Erie, Pa.**
T. Lord, gen. mgr.; T. L. Yates, sales eng.; A. D. Fortier (Detroit).
**Branch offices:**
Security Peoples Trust Bldg., Erie, Pa.; 904 W. Hudson Ave., Royal Oak, Mich.
**Accessories:**
Vibration dampers (rubber; shear mounting.) (*Ju*).

**The Lunkenheimer Co.**
**Cincinnati, Ohio**
**Branch offices:**
N. Y. C.; Chicago; Boston; Philadelphia.
**Accessories:**
Primers, strainers, cocks and fittings (fuel and oil lines). (*Ju.*)

## M

**Magosy & Buscher**
**120 Walker St., New York, N. Y.**
**Accessories:**
Streamlinings (collector rings; cowls). (*Ju.*)

**Marlin-Rockwell Corp.**
**Jamestown, New York**
H. K. Smith, pres.; A. C. Davis, vice-pres.; H. A. Johnson, sales mgr.; L. A. Cummings, chief eng.
**Accessories:**
Bearings (ball; rocker arm; superchargers). (*Ju.*)

**Marshall-Fahlin Propeller Co.**
**Marshall, Missouri**
**Accessories:**
Propellers (wood).

**Maynard DiCesare Propeller Corp.**
**Milwaukee, Wisconsin**
P. D. DiCesare; E. J. Waliszenski.
**Accessories:**
Propellers (metal [adjustable pitch; automatic; constant speed].

**McCauley Aviation Corporation**
**2901 W. 3rd St., Dayton, Ohio**
M. Pate, pres. & treas.; E. G. McCauley, vice-pres. & gen. mgr.; J. W. Sharts, sec.
**Accessories:**
Propellers (steel). Blades (solid steel for controllable hubs).

**McCord Radiator & Mfg. Co.**
**Detroit, Michigan**
P. L. Barter, vice-pres. in chg. of sales; A. E. Blomquist, gasket eng.; J. Harris, chief eng.
**Accessories:**
Engine cooling radiators. (*Ju.*)

**Motor Improvements, Inc.**
**Newark, N. J.**
J. A. Graham, pres.; L. W. Williams, chief eng.; R. R. Layte, asst. to pres.
**Branch office:**
Fisher Bldg., Detroit.
**Accessories:**
Filters (fuel; oil). (*Oct.*)

## N

**New Departure Division**
**General Motors Corp.**
**Bristol, Conn.**
F. G. Hughes, vice-pres. & gen. mgr.
**Accessories:**
Ball bearings. (*Ju.*)

**New Haven Clock Co.**
**New Haven, Connecticut**
**Accessories:**
Instruments (clocks).

**Norma-Hoffmann Bearing Corp.**
**Stamford, Connecticut**
W. M. Nones, pres. & treas.; O. P. Wilson, vice-pres.; H. J. Ritter, sec. & sales mgr.; G. R. Bott, chief eng.; D. E. Batesole, asst. chief eng.; C. B. Malone, factory mgr.; H. L. Day, plant supt. District sales and engineering representatives—F. W. Mesinger (N. Y. C.); R. E. Hecker (Cleveland); T. J. Harley (Chicago); M. B. Hawxhurst (Detroit); A. A. Van Pelt (Pittsburgh); C. D. Kilham (Cincinnati); E. W. Lawrence (Decatur).
**Branch offices:**
155 E. 44 St., N. Y. C.; Hanna Bldg., Cleveland; 310 S. Michigan Ave., Chicago; Eaton Tower Bldg., Detroit; 105 Fahnestock Rd., Pittsburgh; American Bldg., Cincinnati; 632 E. Lake Drive, Decatur, Ga.
**Accessories:**
Bearings (precision ball; roller; thrust). (*Ju.*)

**Northill Company, Inc.**
**700 S. LaBrea Ave., Los Angeles, Calif.**
A. Wilbur, mgr.; Ed. Zuchelli, sales mgr.; J. C. Patterson, prod. mgr. Sales Representatives: R. K. Johnson (N. Y. C.); C. J. Brophy (Detroit); D. S. Guild (St. Louis); C. P. Mertens (Chicago); E. C. Boggs (Miami Beach); H. A. Jones (Vancouver).
**Branch offices:**
70 Pine St., N. Y. C.; 1539 Garland, Detroit; P. O. Box 682, St. Louis; 4000 Royal Palm Ave., Miami Beach; 407 W. Cordova St., Vancouver, B. C.; Amer. Equipment Co., 111 W. Washington St., Chicago.
**Accessories:**
*Northill* folding anchors. (*Ja.*)

**Northwest Air Service, Inc.**
**Seattle, Washington**
Alan L. Blum, pres.
**Accessories:**
Skis (*Oct.*)

## P

**Pacific Scientific Co.**
**Bendix Bldg., Los Angeles, Calif.**
W. P. Balderston, pres.; D. G. McAllister, vice-pres.; D. H. Grubb, sec.-treas.
**Branch offices:**
25 Stillman St., San Francisco.
**Accessories:**
Instruments.

**The Pantasote Co., Inc.**
**250 Park Ave., New York. N. Y.**
F. R. Outerbridge, pres.; R. Harvey, vice-pres.; P. J. Hickey, mgr. fabrics dept.
**Factory:**
Passaic, N. J.
**Accessories:**
Cockpit and engine covers (*CC Textasote*). Parachute pack covers. (*Pantex*). (*Ju.*)

**Parker Appliance Co.,**
**Cleveland, O.**
A. L. Parker.
**Accessories:**
Tube couplings. Valves. Fuel units. Engine primers. (*Ju.*)

**Parker-Kalon Corp.,**
**New York, N. Y.**
S. S. Kahn, asst. sales mgr.
**Accessories:**
Fasteners. (*Ju.*)

**Pass & Seymour, Inc.**
**Syracuse, N. Y.**
R. H. Pass, pres.; J. W. Brooks, vice-pres.; V. R. Despard, vice-pres.; C. L. Nicholson, II, indust. sales mgr.
**Accessories:**
Switches (toggle).

**Philco Radio & Television Corp.**
**Philadelphia, Pennsylvania**
L. E. Gubb, pres.; S. M. Romsdell, vice-pres.; R. L. Heberling, vice-pres.; T. A. Kennally, sales mgr.; W. S. Camner, exp. mgr.
**Accessories:**
Radios.

**Philadelphia Storage Battery Co.**
**Philadelphia, Pennsylvania**
**Accessories:**
Storage batteries.

**Pioneer Gen-E-Motor Corp.**
**466 W. Superior St., Chicago, Ill.**
D. E. Bright, pres.
**Export representatives:**
M. Simons & Son Co., Inc., 25 Warren St., N. Y. C.

*(Continued on following page)*


*Announcing*

our appointment as distributors for the

# RYAN S-T



*in*

EASTERN PENNSYLVANIA
SOUTHERN NEW JERSEY
DELAWARE

First introduced on the West Coast, where it is extremely popular—and more recently in the East, where it is making a name for itself—the popular RYAN S-T now is available to individuals and dealers in Eastern Pennsylvania, Southern New Jersey and Delaware.

Demonstrations—without obligation—will begin March 15th. You are invited to write, wire or phone so that we may arrange an appointment at your convenience.

Primary and advanced flight training also available in carefully maintained equipment, by experienced instructors, at reasonable rates.

*We should like to discuss with prospective dealers* RYAN'S *successful sales plan—and open territories in the region mentioned above.*

DEMORR AERONAUTICAL CORP.
MAIN LINE AIRPORT PAOLI, PENNA.
*Phone: Paoli 1987*

(*Continued from preceding page*)

Branch offices:
136 Liberty St., N. Y. C.
Accessories:
Dynamotors (aircraft radio receivers; transmitters).

**Pioneer Instrument Company, Inc.**
**754 Lexington Ave., Brooklyn, N. Y.**
Vincent Bendix, pres.; H. L. Bill, gen. mgr.; R. P. Lansing, vice-pres.; W. A. Richel, vice-pres. & chief eng.; R. H. Isaacs, sales mgr.
Export representatives:
Curtiss Wright Export Co., R. C. A. Bldg., N. Y. C.; (Argentina); Prouds, Ltd., Sydney, Australia; Casa Mayrink Veiga, 17 Rua Mayrink Veiga 21, Rio de Janeiro, Brazil; Ontario Hughes Owens Co., Ottawa, Canada; China Airmotive Co., Development House, Shanghai, China; Manuel Toro, Edificio del Banco de la Republica, Bogota, Colombia; Transo Trading Co., St. Konensgade 27, Copenhagen, Denmark; A. Reichel, P. O. Box 106, Tallinn (Reval), Estonia; Fenno-Avia, Arne-Linna, Helsinki, Finland; Air Equipment, 64, Avenue Edouard-Vaillant; Boulogne-Billancourt, Seine, France; A. J. deHulla, Parkweg 318, Voorburg vij den Haag, Holland, and J. C. Grootenhuis, P. O. Box 388, Wijnhaven, 23, Holland; George S. Ippa, Pasto Dezute NR 45, Kaunas, Lithuania; H. G. Fletcher, Madero, 2, Mexico City, Mexico; A/S T Winther, Toldbodgt 3, Oslo, Norway, and Molbach-Thellefsen, Storthingsplass 7, Oslo, Norway, Kolberg & Co., Chociniska 22, Warzawa 12, Poland; Andre Mano, 3a Strada, Boteanu, Bucarest, Rumania; International Engineering Co., P. O. Box 39, Bangkok, Siam; Aero Material, 6 Birger Jarlsgatan, Stockholm, Sweden; Eugenio Dubois Piquet, Alberto Aguilera, 58, Madrid, Spain; W. H. Smyth, Milosa Velikog 23, Belgrade, Yugoslavia.
Accessories:
Instruments (airspeed, bank, bank and turn, rate of climb, drift and turn indicators; altimeters, accelerometers; ammeters; clock; compasses; fuel level, manifold pressure, fuel and oil pressure, suction gauges; octants, tachometers; thermometers; voltmeters; warning indicators; watches) *Ring-Light* instrument lighting, Pitot static tubes. Switches *Autosyn* instruments and accessories. Instrument board and compass lights. Wiley parachute flares. Hand fuel pumps. Anti-spill vents. Tachometer shafts.

**Pittsburgh Screw & Bolt Co.**
**Pittsburgh, Pennsylvania**
Accessories:
Propeller blades.

**Prest-O-Lite Battery Co., Inc.**
**Indianapolis, Indiana**
J. H. McDuffee, pres.; H. E. Komitch, sales mgr.; H. D. Wilson, chief eng.
Factories:
Oakland; Toronto.
Branch offices:
Oakland; Toronto.
Accessories:
Storage batteries.

**Pump Engineering Service Corp.**
**Cleveland, Ohio**
Wm. S. Jack, pres.; J. P. Johnson, vice-pres. & gen. mgr.; Wm. R. Jack, treas.; representatives: G. A. Gray, Munsey Bldg., Washington, D. C.; Fred M. Marshall, 108 Maplewood, Dayton.
Accessories:
Pumps (*Pesco* fuel, vacuum, high pressure). Primers. Valves (suction relief, pressure relief, fuel valves). Generators. Motor turbines. Hydraulic systems. (*Ju.*)

**The Pyle-National Company**
**Chicago, Illinois**
Jack Vilas, mgr., aero. dept.
Branch offices:
Grand Central Terminal Bldg., N. Y. C.; Boatmen's Bank Bldg., St. Louis; Builders Exchange Bldg., St. Paul; Hobart Bldg., San Francisco.
Accessories:
Aircraft lighting units (landing lights; navigation lights). Lighting accessories. (*Oct.*)

**Pyrene Manufacturing Co.**
**Newark, New Jersey**
E. A. Clapp, pres. & treas.; E. J. Waring, vice-pres. & gen. mgr.; E. G. Weed, vice-pres. and sec.; G. H. Boucher, gen. sales mgr.; J. P. Maloney, gen. field sales mgr.; district mgrs.: J. P. Bradner (San Francisco); W. L. Ferriet (Chicago); W. A. Beaumont (Atlanta); N. Bauer (Newark); G. R. LeCerff, export manager.
Export representatives:
Pyrene Mfg. Co., of Canada, Ltd., 91 Don Roadway, Toronto, Canada; Pyrene Co., Ltd., Great West Rd., Brentford, Middlesex, England; Ets. Phillips & Pain, 31, Rue de la Vanne, Montrouge, Seine, France.
Branch offices:
242 Spring St., N. W., Atlanta; 444 W. Grand Ave., Chicago, Ill.; 977 Mission St., San Francisco.
Accessories:
Fire extinguishers. Fire extinguishing equipment. (*Oct.*)

## R

**RCA Mfg. Co., Inc., Camden, N. J.**
E. T. Cunningham, pres.; G. K. Throckmorton, exec. vice-pres.; F. H. Corregan, vice-pres. & sec.; L. B. Morris, vice-pres. & gen. counsel; D. S. Little, mgr. aviation radio sales; F. X. Rettenmeyer, chief, aviation radio engineering.
Export representatives:
RCA Victor Co. of China, P. O. Box 123, Hong-Kong; 756 cr. Peking & Honon Rds., Shangai; 74-76 Isemachi, Dairen, Manchoukuo. RCA Victor Mexicana S. A., Calzada Villalongin 196, Mexico, D. F. RCA Mfg. Co., Inc., Electra House, Victoria Embankment, London W. C. 2, England. RCA Victor Co., Ltd., St. Antoine & Lenoir Sts., Montreal, Canada. RCA Victor Argentina, Bartolome Mitre No. 1976, Buenos Aires, Argentina. RCA Victor Brasileira, Inc., Caixa Postal No. 2726, Rio de Janeiro, Brazil. RCA Victor Chilena, Inc., Casilla No. 1407, Santiago, Chile.
Branch offices:
Air Associates, Inc., Roosevelt Field, Garden City, N. Y.; Municipal Airport, Chicago; Grand Central Air Terminal, Glendale.
Accessories:
Radio receivers, Radio compasses, Aircraft radio transmitters. Airport communication and navigation equipment. (*Oct.*)

**Radio Frequency Laboratories, Inc.**
**Boonton, New Jersey**
C. B. Seabury, pres.; R. W. Seabury, Jr., vice-pres.; L. R. Damon, chief eng.
Accessories:
Radios (navigation; communication). (*Oct.*)

**Radio Navigation Instrument Co.**
**22 E. 40th St., New York, N. Y.**
Accessories:
Radio compasses. (*Oct.*)

**Reading Batteries, Inc.**
**Reading Pennsylvania**
D. R. Bomberger, pres. & treas.; Wm. L. Wahl, vice-pres.; J. T. Moore, Jr., gen. mgr. aircraft division.
Accessories:
Storage batteries (Non-spillable).

**Romec Pump Co., Elyria, Ohio**
E. W. Beidler, pres.; H. Eames, vice-pres.; W. L. Davis, gen. mgr.; B. A. Schulze, sec-treas.
Export representatives:
Bohdan Werner, Warsaw, Poland; China Airmotive Corporation, 25 Beaver St., N. Y. C.; Technische Handelmij, Hollinda, N. V., Lange Viverberg 13, The Hague, Holland.
Branch offices:
Pacific Scientific Co., Los Angeles and San Francisco.
Accessories:
Pumps (engine; instrument; fuel (balanced relief and by-pass valve); vacuum; deicer; emergency hand). Relief and by-pass valves. Engine accessory drive box. (*Ju.*)

**Richland Auto Parts Co., Inc.,**
**Mansfield, Ohio**
O. P. Crouse, sec. & treas.; J. O. Crouse, gen. mgr.
Accessories:
Controls (push-pull and locking). Defrosters.

**Rieker Instrument Co.**
**Philadelphia, Pennsylvania**
W. C. Rieker, pres. & mgr.; E. G. Rieker, factory mgr.
Accessories:
Instruments (bank indicators).

**E. S. Ritchie & Sons, Inc.**
**Brookline, Massachusetts**
R. C. Ritchie, pres.
Branch offices:
Air Associates, Inc., Garden City, N. Y.; Chicago; Glendale.
Accessories:
Aperiodic compasses. Radio compasses.

**Robinson Fire Apparatus Mfg. Co.**
**4250 N. 12th St., St. Louis, Mo.**
Accessories:
Fire extinguishers.

**George Ruehfel Co.**
**Brooklyn, N. Y.**
H. B. Lagerhalm.
Accessories:
Instruments.

**Russell Mfg. Co., Middletown, Conn.**
G. M. Williams, pres.; C. E. Harwood, sales mgr.; R. E. Dowd, aero. eng. (Chicago); R. W. Conroy, Pac. coast mgr. (San Francisco).
Branch offices:
549 E. Illinois St., Chicago; 1157 Post St., San Francisco.
Accessories:
Shock cord. *Rusco* aero rings. Safety belts. Brake lining. Miscellaneous heavy webbing.

## S

**SKF Industries, Inc.**
**Philadelphia, Pennsylvania**
Dr. W. L. Batt, pres.; R. F. Runge, vice-pres.; R. H. DeMott, sales mgr.; G. Palmgren, chief eng.
Accessories:
Bearings (ball; roller). (*Ju.*)

**S & M Lamp Co.**
**Los Angeles, Calif.**
Wm. G. Shirreffs, mgr., aero. div.
Accessories:
Landing and warning lights.

**A Schrader's Son, Brooklyn, N. Y.**
R. L. deBrauwere, sales mgr.; F. J. McHugh, export mgr. Managers: M. C. Stevens (Akron); G. A. Drew (Los Angeles); P. C. Evans (Detroit).
Branch offices:
705 Johnston St., Akron; 2627 Santa Fe Ave., Los Angeles; New Centre Bldg., Detroit.
Accessories:
Tire valves and parts. Airplane tire pressure gauges. (*Oct.*)

**Scintilla Magneto Co., Inc.**
**Sidney, New York**
Vincent Bendix, pres.; H. Hanni, vice-pres. & gen. mgr.; T. Z. Fagan, vice-pres.; W. J. Spengler, chief eng.
Accessories:
Engine ignition (magneto; battery). Switches( ignition and special). H-T spark plugs. (*Ja.; Ju.*)

**Seabury & Johnson**
**222 Fourth Ave., New York, N. Y.**
A. Ast, gen. sales & adv. mgr.
Accessories:
First aid kits and supplies. (*Oct.*)

**Sensenich Brothers**
**Lititz, Pennsylvania**
Harry M. and Martin M. Sensenich, prop.
Accessories:
Propellers (wood).

**Shakespeare Products Co.**
**Kalamazoo, Michigan**
Wm. Shakespeare, Jr., pres.; S. G. Russell, vice-pres.; H. Weber, experimental design eng.; H. Shakespeare, prod. mgr.; D. E. Wallace, sales eng.
Accessories:
Controls (throttle; propeller; choke; spark; heater).

**Shinn Devices Corp., Butler, Pa.**
H. Shinn, pres.; D. Barr Peat, vice-pres.
Export representatives:
Aviation Equipment & Export, Inc., 25 Beaver St., N. Y. C.
Accessories:
Wheels and brakes.

**Shore Instrument Co.,**
**Jamaica, New York**
Accessories:
Instruments.

**Simplex Electric Co.**
**Indianapolis, Indiana**
Earl W. Springer.
Accessories:
Aircraft radios (transmitters; receivers). Oil immersion heaters.

**Skyview Camera Co.,**
**Cleveland, Ohio**
D. Worster.
Accessories:
Aerial cameras.

**Solar Aircraft Co.**
**San Diego, Calif.**
E. T. Price, pres.; C. S. Marston, vice-pres. & secy.; L. E. Wheeler, vice-pres.; A. W. Briggs, treas.; J. Seamons, chief eng.; A. A. Mathewson, Jr., sales mgr.
Accessories:
Exhaust manifolds. Aircraft parts. (*Ju.*)

**Sperry Gyroscope Company, Inc.**
**Brooklyn, New York**
R. E. Gillmor, pres. & gen. mgr.; P. R. Bassett, vice-pres. & chief eng.; R. B. Lea, vice-pres. in chg. of sales; A. Schein, vice-pres. in chg. of mfg.; C. D. Jobson, mgr. aero. dept.; S. W. Bedell, mgr. export dept.
Accessories:
Instruments (gyro-horizon; directional gyro; gyropilot). Soundproofing systems. (*Oct.*)

**Star Compass Co., E. Milton, Mass.**
Accessories:
Instruments (compasses).

**The Steel Products Engineering Co.**
**Springfield, Ohio**
W. C. Jordan, gen. mgr.
Accessories:
Instruments (segregators). (*Ju.; Oct.*)

**Stempel Fire Extinguisher Mfg. Co.**
**St. Louis, Missouri**
H. A. Greene, pres.; F. M. Greene, vice-pres.; H. O. Lodes, gen. mgr.; H. A. MacGregor, gen. mgr. (Seattle).
Factories:
Philadelphia; St. Louis; Seattle.
Branch offices:
Los Angeles; San Francisco; Seattle; Philadelphia.
Accessories:
Fire extinguishers and fire extinguishing equipment. Rubber tubing. Sheet packing for gaskets. (*Oct.*)

**Stewart-Warner Corp., Chicago, Ill.**
G. Zahn, mgr., Stewart-Warner div.; C. A. Fine, Alemite div.; J. E. Burke, export mgr.
Accessories:
Instruments (tachometers; oil and temperature gauges). Filters (fuel). Fuel pumps. *Alemite* lubrication fittings. (*Oct.*)

**Stone Propeller Co., Wichita, Kans.**
Accessories:
Propellers (wood).

**Story-Gawley Company**
**Glendale, Calif.**
Accessories:
Propellers (wood).

**Struthers Dunn, Inc.**
**Philadelphia, Pennsylvania**
J. Struthers Dunn, pres.; W. L. Kennedy, vice-pres.; J. F. McAllister, sec. & gen. mgr.
Accessories:
Electrical relays. Control devices.

**Switlik Parachute & Eqpt. Co.**
**Trenton, New Jersey**
Stanley Switlik, pres. & gen. mgr.
Export representatives:
Souza Sampaio & Cia Ltda., Rua General Camara 73, Rio de Janeiro, Brazil; Handelshaus, Zadruga, Graf-Ignatiew- str. 18, Sofia, Bulgaria; H. G. Fletcher, Madero 2, Despacho 1, Mexico, D. F.; C. Santos Lda., 57, Rua Do Crucifixo, Lisboa, Portugal; C. K. Turnbull, Diag. R. Saenz

Pena 501, U. T. 33, Avda, 5977, Buenos Aires.
Accessories:
Parachutes. (*Safety Chute*) Engine and cockpit covers.

## T

**Taylor Instrument Companies**
**Rochester, New York**
H. J. Winn, pres. & treas.; P. R. Jameson, dir. of sales; F. K. Taylor & W. M. Griffith, sales mgrs.
Accessories:
Instruments. (*Ja.; Oct.*)

**Teicher Manufacturing Corp.**
**Long Island City, N. Y.**
Arthur A. Teicher, pres.
Accessories:
Streamlinings (cowlings). Spinners; fairings; exhaust rings; nose and tail hull sheeting. (*Ju.*)

**Timken Roller Bearing Co.**
**Canton, Ohio**
L. M. Klinedinst, vice-pres. in chg. of sales; W. B. Moore, gen. mgr.
Factories:
Canton and Wooster, Ohio.
Branch offices:
Birmingham, Ala.; Boston; Buffalo; N. Y. C.; Chicago; Cincinnati; Cleveland; Dallas; Detroit; Huntington, W. Va.; Milwaukee; Philadelphia; Pittsburgh; San Francisco; Seattle; Washington, D. C.; Toronto, Canada.
Accessories:
Bearings (ball; thrust; tapered). (*Ju.*)

**Titeflex Metal Hose Co.**
**Newark, N. J.**
E. E. Husted, sales mgr.; C. S. Plunkett, aero. div.
Export representatives:
Imperial Engineering Co., Reconquista 390, Buenos Aires; Europaische Titeflex Metallschlauch, A. G., Friedrich Karl Platz No. 3, Charlottenburg, Berlin, Germany.
Branch offices:
Gen. Motors Bldg., Detroit; Merchandise Mart, Chicago; Hippodrome Bldg., Cleveland; Bourse Bldg., Philadelphia; Walbridge Bldg., Buffalo; 49 Federal St., Boston; 950 Van Ness Ave., San Francisco.
Accessories:
All-metal flexible tubing (fuel lines; radio shielding). (*Ju.*)

**Triangle Parachute Co.**
**Cincinnati, O.**
C. L. Neolcke, mgr.
Accessories:
Parachutes.

**Trimm Radio Mfg. Co.**
**Chicago, Illnois**
C. A. Bottorff, pres. & gen. mgr.; P. A. Bottorff, vice-pres. & chief eng.
Accessories:
Radio appliances (headsets; rubber ear cushions).

## U

**Union Switch & Signal Co.**
**Swissvale, Pennsylvania**
Accessories:
Switches (electrical).

**United Aircraft Products, Inc.**
**Dayton, Ohio**
T. M. Heister, pres.; Jos. G. Lehman, treas.; H. M. Hiester, factory mgr.; R. G. Dykeman, chief eng.
Accessories:
Pumps (hand operated fuel; gear-type fuel). Fuel line strainers. Relief valves (fuel and vacuum; by-pass). Fuel valves. Primer systems. Safety controls. Fuel tank units. Engine controls. Oil coolers. Nose spinners. Torsiometers. Oil temperature regulators. (*Ju.*)

**United American Bosch Corp.**
**Springfield, Massachusetts**
A. T. Murray, pres.; H. Walker, L. Beeh and J. E. Wild, vice-presidents; W. E. Schwarzmann, chief eng.
Accessories:
Magnetos. Battery ignition systems (timer-distributors; ignition coils). (*Oct.*)

**United-Carr Fastener Corp.**
**Cambridge, Massachusetts**
S. Weeks, pres. & treas.; A. W. Kimbell, gen. mgr.; G. S. Maynard, sales director; G. A. Holmes, eng.; A. Corneliussen, export mgr.
Factories:
Cambridge; S. Boston; Hamilton, Ontario, Canada; Nottingham, England; Royal Park, S., Adelaide, Australia.
Branch offices:
15 Madison Sq., N., N. Y. C.; 2832 E. Grand Blvd., Detroit; 35 E. Wacker Drive, Chicago; 251 Post St., San Francisco.
Accessories:
Fasteners (*Dot* for upholstery; wood to metal assemblies; cowl; flush and button types). Zippers. (*Ju.*)

**United States Gauge Co.**
**New York, N. Y.**
L. L. Corcoran, sales eng.
Factories:
Sellersville, Pa.
Branch offices:
Chicago; Philadelphia; Boston; Cleveland; Detroit; St. Louis; Houston; Seattle; Los Angeles; Montreal.
Accessories:
Instruments (gauges [oil; fuel; suction; wheel; manifold]; thermometers; ice warning indicators; *Triplex* engine gauge unit; cabin thermometers; airspeed indicators; fuel quantity gauges).

**United States Rubber Products, Inc.**
**New York, New York**
J. A. Faucher, mgr., airplane tire sales dept.
Factories:
Detroit; Los Angeles; Indianapolis; Passaic, N. J.; Mishawaka, Ind.; Naugatuck, Conn.; Providence; Bristol, R. I.
Accessories:
Tires and tubes (high pressure; low pressure; streamline). Rubber mountings. Toggle straps. Seat cushions. (*Ju.*)

**Universal Aircraft Supply Co.**
**2300 N. 9th St., St. Louis, Mo.**
C. Rauch.
Accessories:
Propellers (wood).

**Universal Alloy Products Co.**
**Lancaster, New York**
Earle M. Scott, sales mgr.
Accessories:
Tail skid shoes. Swivelling tail wheels.

**Universal Microphone Ltd.**
**Inglewood, California**
J. R. Fouch, pres. & gen. mgr.; E. E. Griffin, vice-pres.; I. I. Sevey, sec. & treas.
Accessories:
Microphones. Recorders.

## V

**The Variety Mfg. Co., Dayton, O.**
I. C. Beukelaere, pres.
Accessories:
Wheels (landing; tail).

## W

**Wagner Electric Corporation**
**St. Louis, Missouri**
Accessories:
Brakes (hydraulic). Brake lining. Electric motors.

**Waltham Watch Co.**
**Waltham, Mass.**
S. M. Clough; C. L. Smith, sales dept.
Accessories:
Instruments (clocks; tachometers).

**Warner Aircraft Co.**
**Detroit, Mich.**
Ralph R. Irwin, vice-pres.
Accessories:
Wheels and brakes. Floats. Shock struts. Skis. Hydraulic brake control units.

**Washington Institute of Technology**
**Washington, D. C.**
Sidney F. Mashbir; C. C. Planck.
Accessories:
Blind landing systems.

(*Continued on following page*)





*Speed Range*
**15 miles in high**
**7 miles intermediate**
**3 miles in low**

TORO
HUSKY
**A Tractor Well Fitted For Airport Needs**

A sturdy, powerful, fast utility machine that competently handles towing, shunting, hauling, mowing and snow plowing. A real help in year 'round airport maintenance. A reliable tractor that stands ready to perform to satisfaction whenever called upon.

**Facts of Interest**

Wheel Base.....71 inches
Turning Radius..6¾ feet
Motor.....Ford 40 H.P. Self-starting
Gear Shift.....Standard 3 Speed
Wheels.....Pneumatic tires or steel with Spiked rears.

**Price**
**$720**
**F. O. B. Factory**

THERE ARE INTERESTING CATALOGS ON TORO MOWERS and TRACTORS
*WRITE TODAY*

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Racing plane response at 150, training plane landings at 42, automobile economy of operation—that's the new Menasco-powered Ryan, and don't decide on any ship until you've flown it!

We invite you to come out and see for yourself.

**BRAMAN-JOHNSON**
*Flying Service, Inc.*
HANGAR B, ROOSEVELT FIELD, MINEOLA, LONG ISLAND



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TAKE a tip from the pilots of the Clipper ships—equip with Bausch & Lomb Binoculars. Buildings and landmarks, beacon numbers and emergency fields come up sharp and clear, even in dirty weather. Write for 40-page catalog and special folder. Bausch & Lomb Optical Co., 429 Lomb Park, Rochester, N. Y.



7 power, 35 mm Binocular, $86

**BAUSCH & LOMB**
*Binoculars*
THE WORLD'S BEST—BY ANY TEST


(*Continued from preceding page*)

**Weems System of Navigation**
**Annapolis, Maryland**
Comdr. P. V. H. Weems.
Accessories:
Instruments (navigation equipment; aperiodic compasses; sextants; second-setting navigation watches; Dalton Mark VII and E-1A computers; plotters Mark II; Gatty drift indicators; ground speed and drift meters).

**Welch Aircraft Industries**
**South Bend, Ind.**
Orin Welch; F. W. Bower.
Accessories:
Wheels. Tires.

**Western Electric Co., N. Y., N. Y.**
H. E. Young, gen. commercial eng.; E. W. Thurston, commercial sales eng.; H. N. Willets, radio eng.; F. C. McMullen and D. R. Husted, aero. radio specialists.
Factories:
Kearny, N. J.; Hawthorne Station, Chicago; Baltimore.
Accessories:
Radio (receivers; transmitters; direction finders; accessories; anti-noise microphones; headsets; telephone sets; interphone equipment; dynamotors; control units; cords; plugs; jacks; cable; vacuum tubes). (*Oct.*)

**Westinghouse Elec. & Mfg. Co.**
**East Pittsburgh, Pennsylvania**
Branch offices:
Akron; Albany; Allentown, Pa.; Appleton, Wisc.; Atlanta; Bakersfield, Calif.; Baltimore; Beaumont, Tex.; Birmingham; Bluefield, W. Va.; Boston; Bridgeport; Burlington, Vt.; Butte, Mont.; Canton; Charlotte, N. C.; Chattanooga; Chicago; Cincinnati; Cleveland; Columbus, O.; Dallas; Davenport, Iowa; Dayton; Denver; Des Moines; Detroit; Duluth; Eastport, Me.; El Paso; Emeryville, Calif.; Erie, Pa.; Evansville; Fairmont, W. Va.; Fort Wayne; Fort Worth; Gary, Ind.; Grand Rapids; Greenville, S. C.; Hammond, Ind.; Hartford; Houston; Huntington, W. Va.; Indianapolis; Ishpeming, Mich.; Jackson; Johnstown, Pa.; Kansas City, Mo.; Knoxville; Little Rock; Los Angeles; Louisville, Ky.; Madison; Marshall, Tex.; Memphis; Miami; Milwaukee; Minneapolis; Monroe, La.; Nashville; Newark; New Haven; New Orleans; New York City; Niagara Falls; Norfolk, Va.; Oklahoma City; Omaha; Peoria; Philadelphia; Phoenix, Ariz.; Pittsburg, Kans.; Pittsburgh; Portland, Me.; Portland, Ore.; Providence; Raleigh, N. C.; Richmond; Rochester, N. Y.; Rockford, Ill.; Sacramento; Salt Lake City; San Antonio; San Francisco; Seattle; Sioux City; South Bend; Spokane; Springfield, Ill.; Springfield, Mass.; St. Louis; Syracuse; Tacoma; Tampa; Toledo; Tulsa; Utica; Washington, D. C.; Waterloo, Iowa; Wichita; Wilkes-Barre, Pa.; Worcester; York, Pa.; Youngstown, O.
Accessories:
Micarta pulleys, fairleads, bushings, bearings. Micarta instrument and terminal boards. Micarta cabin lining. Battery indicators. Generators. No-fuse panelboards. Dynamotors. Radio receivers, transmitters, and direction finders. Sentinel breakers. Landing light lamps. Electrically-operated fuel valves. (*Ja.*; *Ju.*; *Oct.*)

**Weston Electrical Instrument Co.**
**Newark, New Jersey**
H. M. Ricks, mgr., aircraft and tachometer sales div.
Export representatives:
Cia Standard Electric Argentina, Calle Cangello 1286, Buenos Aires, Argentina; Oskar Orgel Webgasse 19, Vienna, Austria; Warburton, Franki Ltd., Sydney, Melbourne & Brisbane, Australia; Anciens Etablissements V. Duquesne & Cie, 13 Rue Liedts, Brussels, Belgium; Banho & Co., Rio de Janeiro, Brazil and Jack Leonard, Rua Barado Itapetininga 297, 1° Andar, Caixa Postal 573, Sao Paulo, Brazil; Besa y Cia. Ltda, Santiago, Chile; China Electric Co., Ltd., Shanghai, Peiping, Tientsin, Hong-Kong, Canton and Hankow, China; Ramon Cuellar M., Apartado Nacional 976, Bogota, Colombia; Antiga & Co., Havana, Cuba; Rudolf Guth, Skuherskehe 23/25, Prag VI, Czechoslovakia; Otto Arens, Nor Frihavnsgade 13, Copenhagen, De mark; Lindeteves, Stokvis, Sama rang, Soerabaya, Batavia & princip cities, Dutch possessions; Stell Tzoulakis & Co., Alexandria ar Cairo, Egypt; Firma R. Kuusner Co., Valli 10, Tallinn, Estonia; Finnish Electric Ltd., Helsingfor Finland; Material Electrique Controle et Industriel, Paris, France Ing. Edmund Zierold, Berlin, Schoe berg, Germany; C. Tavaniotis, 17- Bucharest St., Athens, Greece Hawaiian Elec. Co., Ltd., Honolul Hawaii; Hulsewe Ingenieursbure Amsterdam, Holland; Carl Enge Vorosmarty-utca 16, Budapest VI Hungary; M. S. Vernal & Co., C cutta, India; Ing S. Belotti & S.A., Milan, Italy; Mitsubishi Sh Kaisha, Tokyo, Japan; Noris, S cietate de Electricitate, Zagreb a Beograd, Jugoslavia; Valsts Elektr techniska Fabrika, Riga, Latvi VEF, Latvijas Valstybinio Elektr technikos, Fabrikos, Kaunas, Lithu nia; Bourchier Comercial, S. de R.L Mexico, D.F.; Standard Telephone Cables Ltd., 24-26 Ballance St Wellington, New Zealand; Maski Aktieselskapet Zeta, Drammensvei 26, Oslo, Norway; Messrs. Levins Bros., Tel-Aviv, Palestine; Juan Goicochea, Casilla Correo No. 142 Lima, Peru; Western Equipment Supply Co., Manila, P. I.; Elektr produkt, Warsaw, Poland; Standar Electric (Lisbon), Portugal; S cietate de Electricitate (Noris Bucharest, Cluj and Timisoar Roumania; International Enginee ing Co., Inc., Bangkok, Sian Bartle & Co., Johannesburg, Sou Africa; Standard Electrica S. A Madrid and Barcelona, Spain; A tiebolaget Zander & Ingestro Stockholm, Sweden; Weston Ele trical Instrument Co., Surbiton, Su rey, England; Alfred Schiffmann Monbijoustrasse 69, Bern, Switze land; Establissements "Helios", O. Box Galata 1400, Istanbul, Tu key; J. V. Vallega, Bartolome Mit 1425, Montevideo, Uruguay; Cor pania Bauer, Esquina de Camej Caracas, Venezuela.
Branch offices:
50 Church St., N. Y. C.; 205 W Wacker Dr., Chicago.
Accessories:
Instruments (tachometers; cylinde air, carburetor and oil temperatu indicators; thermometers; therm couples; radio compass indicator volt - ammeters; ammeters; vo meters). Radio shielding. Test osc lators. Selective analyzers. Capaci meters. (*Oct.*)

**The S. S. White Dental Mfg. C**
**Philadelphia, Pennsylvan**
G. T. Latimer, mgr., and J. C. Smac asst. mgr., Industrial Div.
Branch offices:
10 E. 40 St., N. Y. C.
Accessories:
Molded resistors for radios.

**Kelvin & Wilfrid O. White Co.**
**90 State St., Boston, Ma**
Wilfrid O. White, pres.; Francis We eng. aircraft div.
Branch offices:
38 Water St., N. Y. C.
Accessories:
Instruments (*Telemagnetic* co passes).

**Willard Storage Battery Co.**
**Cleveland, Oh**
S. W. Rolph, vice-pres. & gen. mgr.; G. Teufel, gen. sales mgr.; H. Evans, sales prom. mgr.; V. W. Mc roe, exp. mgr.
Accessories:
Storage batteries.

## Y

**Yale & Towne Manufacturing C**
**Stamford, Connectic**
Accessories:
Locks.

## Z

**Zenith Radio Corp.**
**3620 Iron, Chicago,**
E. F. McDonald, Jr., pres. & g mgr.; H. Robertson, exec. vice-pres. treas.; E. A. Tracey, vice-pres. in ch of sales.
Accessories:
Radios.

# DIGEST OF THE NEWS

## PRIVATE FLYING

### Awards

The Harmon Trophy for 1936 was awarded to Howard Hughes for his outstanding contributions to the science of aviation. Hughes was chosen for the award by the American Section of the Ligue Internationale des Aviateurs which is composed of Col. Charles W. Kerwood, Harry A. Bruno, Admiral Richard E. Byrd, Commander Frank Hawks, Col. Harold Hartney, Capt. Casey Jones, Major Clayton Knight, Capt. Eddie Rickenbacker and Commander James Taylor.

* * *

Outstanding racing pilot for 1936 is Roger Don Rae, of Lansing, Mich., who was chosen for this position on the basis of points won in major air meets during the year. Rae also topped the list of best winner of parachute jumping contests for 1936.

### Club Activities

The annual aviation ball sponsored by the Maryland Flying Club will be held April 3 at the Hotel Belvedere, Baltimore. The committee in charge of arrangements is headed by Dr. H. H. Young and H. A. Kelly, Jr.

* * *

Fifty of the sixty members of the Bridgeport Flying Club attended the National Aviation Show, coming to New York in chartered busses. The club operates from the Mollison airport and owns three planes. Dr. Joseph L. Levy is president; D. K. Warner and T. Zielro, vice presidents; and Ridgeway Poole, secretary.

* * *

There has recently been formed at Villanova University the Villanova Flying Club which will be affiliated with the International Collegiate Flying Club.

## AIR SERVICES

### Bomber Delivered

Second of the new Cyclone-powered Boeing YB-17 bombers for the U. S. Army Air Corps was delivered to March Field after a 5 hr. 15 min. flight from Seattle. The first bomber is at Wright Field and the third is now being prepared for test flights at Seattle. Ten others are under construction for the Air Corps at the Boeing plant.

### Winter Maneuvers

More than three weeks of intensive flying and experimentation featured the winter maneuvers which got under way at Selfridge Field on Feb. 1 and continued until Feb. 24. These tests involved close to 330 enlisted men and 100 officers from Langley, Barksdale, Mitchel and Selfridge fields. Under the command of Col. Walter H. Frank, of Mitchel Field, the maneuvers were designed to test equipment and personnel under severe winter flying conditions.

### Reserve Activity

Reserve flying officers in the newly-created 338th Observation Squadron will take over operation of a regular army squadron this summer as part of the War Department's program for augmented training of reserve pilots. The Squadron will headquarter in Oklahoma City with other units at Dallas, Houston and Denver or Albuquerque. A service unit will be stationed in Tulsa.

### 1936 Procurement

The Secretary of War announced recently that 506 airplanes were delivered to the Army Air Corps by contractors during the calendar year 1936. This is the largest number of airplanes which has ever been delivered during any year since the adoption of the all-metal airplane for Army Air Corps' use.

## SCHOOLS

### New Schools

Lyon Air Services recently organized at San Francisco Airport is offering a complete fixed-base operation, including student training, passenger and sight-seeing flights, charter work and aerial photography. In addition, the company has taken delivery on a new Ryan S-T-A and is representing the Ryan company in that area.

* * *

Clayton V. Kennedy is offering courses in acetylene and general welding practice at Dearborn, Ala. Kennedy is experienced in structural drafting and aircraft design.

* * *

With the reorganization of his company and the purchase of a new Ryan, the Los Angeles institution headed by Marion McKeen is now offering instruction in primary and acrobatic work, as well as in instrument flying. McKeen also has purchased a Beechcraft which will be used for charter operations.

### Coupe Construction

The all-metal Curtiss-Wright Coupe will be built as a school project by students of the Curtiss-Wright Technical Institute of Aeronautics. Last year the students completed, among other projects, the engineering work and construction of a single-place plane powered by an Aeronca engine. This year, they will concentrate on the production of the two-place all-metal Coupe, which holds an ATC issued by the Department of Commerce.

### 400 Students

Capacity enrollment was enjoyed throughout 1936 by the Casey Jones School of Aeronautics with the average being in excess of 400 students. According to Casey Jones, January and February enrollments were at capacity, and only a few vacancies existed the first of this month. Enrollment was divided equally between day and evening courses, with about half the students occupied in engineering work.

*Cut-away perspective drawing of the new Boeing transport*




## AIRLINES

### 1,020,931 Passengers

The greatest number of passengers in the history of domestic air transportation were carried in 1936 when airline companies operating in the United States showed an increase of 37% over 1935. At 1,020,931 passengers, the best previous year, 1935, was surpassed by a considerable margin, 746,946 passengers having been flown during that period.

The domestic lines flew 63,777,226 miles during 1936 and carried 6,958,777 lbs. of express. The number of passenger miles flown was 435,502,283. Each of these figures represents a new record.

Almost 64% of the total seating capacity of the airliners were occupied during 1936, comparing with 54.83% in 1935.

Figures for lines operating from the U. S. to foreign countries are not yet available.

### TWA Buys New Boeings

Contract for the purchase of six 32-passenger transports, to be the largest of their type when placed in service in this country, has been signed with the Boeing Airplane Co., by Jack Frye, president of Transcontinental & Western Air, Inc. The planes will be powered by four Wright Cyclone G-100 engines, each of which is capable of producing 1205 h.p.

Gross weight of the transports will be 42,000 lbs. and they will be convertible into sleepers with accommodations for 18 berths and 8 seats; they also will carry 3750 lbs. of cargo in addition to passengers. Cruising speed at altitude will be approximately 250 m.p.h., with provision made for supercharging the cabin.

Work on the first of the new planes has already started, and it is planned to place them in service in the Spring of 1938. TWA has also taken an option on 17 additional planes of the same type.

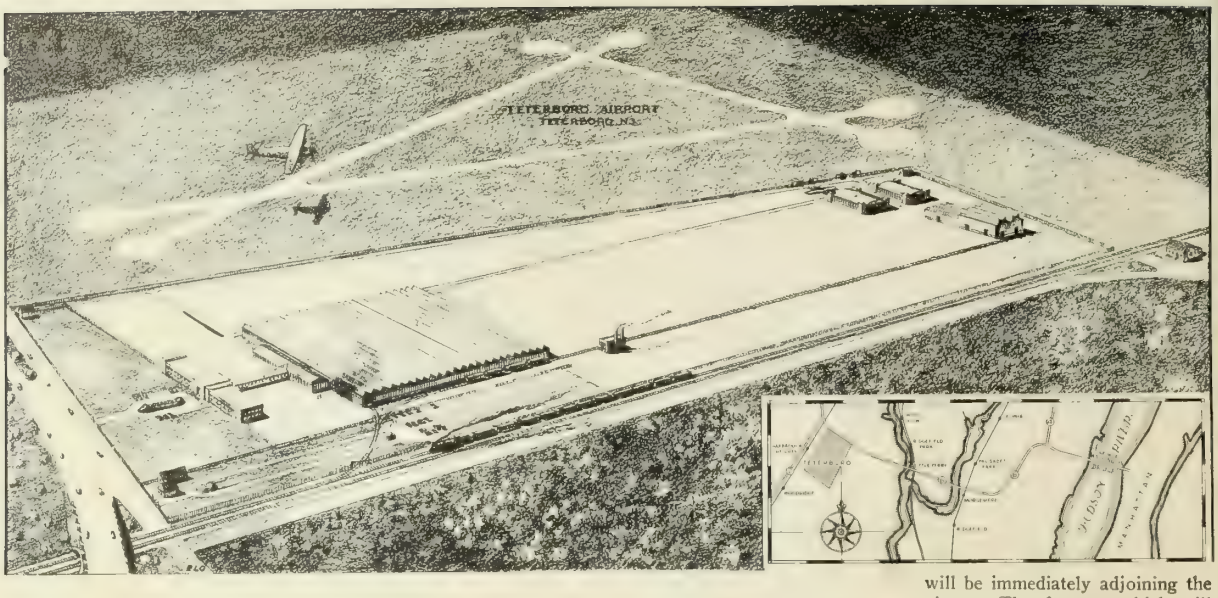
### Personnel Notes

Mme. Pearl V. Metzelthin, specialist in nutrition and dietetics, has joined American Airlines as director of food research. Mme. Metzelthin formerly was food consultant for K.L.M.

* * *

Appointment of H. E. Ramsay as advertising manager for Bran-

(*Continued on following page*)




*Artist's conception of the aviation center Vincent Bendix is building on the Teterboro Airport site in New Jersey*

(*Continued from preceding page*)

iff Airways has been announced by President T. E. Braniff.

* * *

J. C. Graves, regional traffic manager of Transcontinental & Western Air, Inc., has been named president of the Chicago Air Line Ticket Office, Inc. With Graves in the organization are R. Ahrens, first vice-pres. (United Air Lines); F. J. Bixler, second vice-pres. (Northwest Airlines); F. F. Vonnegut, sec. (Chicago & Southern Airlines); and E. J. Eidson, treas.

* * *

New general traffic manager for Northwest Airlines is Leslie H. Farrington who succeeds K. R. Ferguson who has been appointed assistant to the vice-president in charge of operations.

* * *

American Airlines made the following promotions among its pilot personnel: Roy L. Mitchell, former chief pilot at Los Angeles to special assistant to Ft. Worth operations manager; E. L. Sloniger to chief pilot, transcontinental route; and Walter W. Braznell, to chief pilot of Chicago district.

### New Services

Forenoon passenger service from Detroit to Philadelphia is now being offered by United Airlines, with a connection made at Cleveland for passengers leaving Detroit in Pennsylvania Central planes. Service is on a 2 hr. 50 min. basis.

* * *

Mail and passenger service between Minneapolis and Huron has been inaugurated by Hanford Airlines, Inc., using Lockheed Electra transports.

Miami Aero Corp., and Palm Beach Aero Corp., a new organization, recently instituted service between Miami and Palm Beach using Waco and Stinson cabin planes. Service is on a daily, every other hour-on-the-hour schedule. J. Wesley Pape and John Paul Riddle are president and vice-president, respectively, of both corporations.

## INDUSTRY

### 2700 Planes

Production of aircraft in the United States during 1936 reached 2700 units, of which 1559 were commercial types and 1141 military. Compared with production in 1935, activity during 1936 showed a considerable gain inasmuch as manufacture in 1935 accounted for 1109 commercial and 459 military airplanes for a total of 1565.

Engine production also surpassed 1935 figures. During 1936 there were 2433 units produced for commercial use, and 1804 for military use, compared with 1974 and 991 in 1935 respectively.

Deliveries of aircraft and aircraft engines and spare parts during 1936 from all producing companies in the U. S. totaled $76,804,818 as against $41,545,019 in 1935, an increase of 85%. Deliveries of commercial units totalled 1528 valued at $12,535,526 compared to 1046 units valued at $9,669,814 in 1935. Deliveries of military aircraft for 1936 totalled 1024 units compared to 344 units in 1935.

Private flying showed a substantial growth in 1936. Of the total commercial aircraft delivered, 1356 were of the 2, 3, or 4-place type, as compared to 914 of that type in 1935.

### Aviation Center

Plans to rebuild the entire locality around Teterboro Airport, Hasbrouck Heights, N. J. into an aviation center in which he was prepared to spend $3,000,000 were announced by Vincent Bendix.

A complete experimental laboratory and factory will be built and improvements made on the airport to bring it on a par with some of the best equipped airports in the country. The laboratory will measure 100 by 300 feet and will be immediately adjoining the airport. The factory, which will measure 600 by 700 feet, will house the Eclipse Aviation Corp., now in East Orange, and other subsidiaries of the Bendix group.

A feature of the work at the airport will be the testing and improving of the new Bendix system of blind landing which is based on the curved beam method of radio control.

### Aircraft Shows

At least 22 of the country's aircraft manufacturers will display their products at the second annual National Pacific Aircraft & Boat show which will be held in the Los Angeles Pan-Pacific Auditorium, March 13-21.

Space already has been taken for 31 airplanes and for the display of engines produced by Pratt & Whitney, Wright Aeronautical Corp., Jacobs Aircraft Engine Co., Continental Engine Co., Kinner Airplane & Motor Corp., and Warner Aircraft Engine Co. Among the planes to be shown will be the Waterman Arrowbile, the new twin-engined Beechcraft 18, the Lockheed 14, and a deluxe Douglas airliner. Three manufacturers are exhibiting three models, and three others two. Those displaying three planes are Waco, Beech, and Taylor.

Other exhibitors of aircraft include Monocoupe Aircraft Corp. (2), Fairchild Aircraft Corp. (2), Porterfield Aircraft Corp. (2), Western Aeromotive Corp., Petersen Flying Service (Parakeet), Rearwin Airplanes, Inc., Waco Aircraft Co., Aero Engineering Co., Ryan Aeronautical Corp., Stinson Aircraft Corp., Cessna Aircraft Co., Stearman-Hammond Aircraft Corp., Howard Aircraft Corp., Arrow Aircraft Corp.,

(*Continued on following page*)

## Coming Events

Second Annual National Pacific Aircraft and Boat Show, Pan-Pacific Auditorium, Los Angeles, Calif. Cliff Henderson, managing director, Mar. 13-21

•

SAE National Aeronautic Meeting, Mayflower Hotel, Washington, D. C., March 11-12

•

Premier Salon International de l'Aeronautique, Brussels, Belgium. May 26-June 8

First Salon International de Aeronautique. Palais du Centaire, Brussels, Belgium. Sponsored by Ministry of Transport and Belgium Aero Club. June 18-30

•

National Air Races. Municipal Airport, Cleveland, Ohio. Cliff Henderson, managing director. Sept. 3-6

•

SAE National Aircraft Production Meeting. Los Angeles, Calif. Oct. 7-9

# —"EVERY SEAT with a CHUTE"



Cabin interior, looking aft, of the new Stinson Model A, Tri-Motor Private Transport Plane, shown at right, of Mr. Richard J. Reynolds of Winston-Salem, N. C.

## IRVIN-IZE Your Own Ship Like This Latest Tri-Motor Cabin Plane

*More Than* **1500** *Lives Saved*

There is smooth, springy comfort in these four swivel reclining chairs. Yet each is Irvin-equipped, as likewise, are the desk chair and those of the pilot and co-pilot, forward.

Full instant Irvin parachute protection is thus afforded all seven persons for whom this ship gives the utmost in travel pleasure. In your own ship why not enjoy this same pioneer safety insurance? It is the choice and standard of the air forces of the United States, Great Britain and some thirty other governments. Ask today about these—

# IRVIN CHAIR CHUTES

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*(Continued from preceding page)*

Security-National Aircraft Corp., and Swallow Aircraft Co.

The Aluminum Company of America, Bendix Aviation Corp., Berry Bros., Curtiss-Wright Technical Institute of Aeronautics, Pacific Airmotive Corp., Standard Oil Company, and Thompson Products, Inc., all have reserved large space for elaborate displays.

* * *

The National Aviation Show in New York concluded a successful ten-day showing at the Grand Central Palace after attracting more than 190,000 admissions. First of its kind in the metropolitan area in seven years, the aircraft show created extensive interest among exhibitors and visitors and was instrumental in the consummation of a large number of orders for planes. Held under the auspices of the American Legion, Aviator's Post No. 743, and sponsored by the Aeronautical Chamber of Commerce, the show was considered so successful that plans are made for holding it again next year.

### Plant Expansions

Additions to the present Glenn L. Martin plant in Baltimore and the purchase of machinery will cost approximately $2,000,000. Improvements will double the capacity of the plant and will provide a new assembly plant measuring 300 by 500 ft. Of the total to be spent, $600,000 will be for new machinery. The assembly plant will feature a large unobstructed floor area and a 40-ft. headroom, providing space for the accommodation of flying boats twice the size of the Clipper type which were built by the company for Pan American Airways.

* * *

Construction of Grumman Aircraft Engineering Corp.'s new factory at Bethpage, Long Island, N. Y., is rapidly nearing completion. Designed and being erected by the Austin Co., the new Grumman plant will include a manufacturing building, 180 by 400 ft., a 100 by 100 ft. hangar and a two-story office building.

### Personnel Notes

A. A. Mathewson, Jr., has been made sales manager of Solar Aircraft Co., San Diego, Cal.

* * *

Roger Q. Williams is now director and technical advisor for Porterfield Aircraft Corp.

# Digest of Recent Events

**12 Navy Planes In Record Non-Stop Demonstration**

Flying 2553 miles non-stop from San Diego to Honolulu in 21 hours 48 minutes elapsed time, 12 Consolidated Patrol flying boats of the U. S. Navy completed the longest over-water mass flight yet made. The latest flight surpasses the last mass flight made three years ago when Lieut. Comdr. Kneffler McGinnis led a squadron of six flying boats on a similar over-water flight from San Francisco. The elapsed time then was 24 hours 45 minutes. The planes carried 78 officers and men and are to replace obsolete types in the islands. The flight was under the command of Lieut. Comdr. W. M. McDade of Pearl Harbor. JAN. 29

**Martin Bombers Make Mass Flight To Panama**

A 4000-mile round-trip flight from Langley Field to Albrook Field and return was completed by eight twin-engined Martin bombers of the 96th Bombardment Squadron based at Langley Field. With Major J. K. McDuffie in charge, the planes flew from Langley to Miami and then to Panama, and then returned via the same route, marking the first time in the Army's history that a squadron of land planes crossed a large body of water without water landing equipment. The flight was proposed to prove it is unnecessary to maintain a large air force in the canal zone for its defense against possible major attacks. FEB. 11

**British Flying Boat Completes Fast 2000-Mile Test Flight**

*Caledonia,* one of the Empire flying boats destined for experimental transatlantic flights, flew non-stop from Southampton, England to Alexandria, Egypt, in 13 hours 35 minutes, averaging 184 m.p.h. for the 2000-mile flight, which is several hundred miles farther than the Atlantic route from Ireland to Newfoundland. Carrying a crew of five, *Caledonia* has a non-stop range of 3800 miles and will inaugurate transatlantic tests late this spring or early summer in conjunction with two other planes. FEB. 18




. . . on the NAVY'S new LONG RANGE PATROL BOMBERS by CONSOLIDATED

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## DR. KLEMIN'S REPORT

(*Continued from page 27*)

below 100 Oct. Maj. Aldrin thought a time would come when 100 Oct. would be used in continuous operation for economy, particularly as operation with 100 Oct. at cruising indicates that the use of a leaner mixture is possible without overheating. This continuous operation with 100 Oct. would come only when the transport operators consider fuel costs on the basis of ton-mile rather than cost/gallon.

A paper entitled *A New Octane Control and De-Icer* by L. B. Kimball discussed operation with Analohol, a mixture of alcohol and analine. One % of this raises the Octane of fuel 2 numbers and up to 16% the increase in knock rating is a straight line function. When injected in the manifold analohol not only increases the knock-rating but also acts as a de-icer. In flight tests it de-iced a carburetor in 15-25 sec. The use of analohol keeps impeller section clear and free from gum. Graham Edgar criticized the Analohol paper on the grounds that this product has been known for some 10 to 15 years.

A. V. Willgoos (Pratt & Whitney) read an interesting paper *Reduced Maintenance of Aircraft Power Plants.* Care must be taken in engine design and operation to reduce maintenance. Automatic controls have aided in increasing the time between overhauls. At present, oil is changed every 120 hrs., and complete overhaul is made every 600 hrs. Cost of replacements in early overhaul practice was $300 and this was at the end of 300 hrs., whereas, today, replacements total $75 at the end of 600 hrs. The engine should not be considered on the basis of original cost, but rather on cost + maintenance and overhaul.

### Advances in Weather Service

There is no more vital factor in the safety of air transportation than weather service and it was gratifying to hear D. W. Little of the U. S. Weather Bureau outline a number of additional and improved services, and state that during the past year 100 new off-airway stations were placed in operation. These are equipped with the usual instruments including the new Friez micro-barographs, which employ two pressure elements, one placed above the other, insuring accuracy throughout the entire range. A hurricane observation project is under way to record data during hurricanes in the West Indies by pilot balloons and radio meteorographs. The Bureau of Air Commerce in cooperation with the Bureau of Standards is developing a ceiling projector to measure ceilings up to 10,000 ft. Mr. Pagliucia presented an interesting paper on the formation of ice and expressed the hope that a single study correlating all the work in this field might be produced. I. P. Krick (Calif. Inst. of Tech.) presented a new method based on mathematical theory for forecasting the probable time of fog dissipation. The dissipation of fog does not depend upon the thickness of the cloud nor does radiation dissipate fog—rather fog is dissipated by convection turbulence. L. A. Stevens (U. S. Weather Bureau) reported the beginning of an extensive study on upper air data to be taken at various airports and upper air stations.

## DR. WATTER'S REPORT

(*Continued from page 26*)

boats can be considerably improved if the pilot can find and obtain optimum attitudes for take-off. Use of the proposed indicator will permit consistent repetition of attitudes during take-off which will result in training the pilot to approach the best take-off combination and afford a check on the accuracy of basic results in their practical application.

F. L. Thomson (NACA) discussed *The Measurements of Air Speed in Flight.* The paper contains important factors which must be observed when using the trailing type bomb for speed determination. Relative lag in the system and compressibility effect at higher speeds are but two of these factors.

The last paper presented was *Effect of Slipstream on Stability of a Low-Wing Monoplane* by C. M. Bolster (Naval Air Station, Pensacola). It presented the results of wind tunnel tests on a model of a single-engined low-wing airplane equipped with an electric motor and propeller to simulate the condition of flight with power-on. In order to explore the effect of the propeller slipstream tests were made with different locations of the horizontal tail surfaces and also with the horizontal surfaces removed. This permitted obtaining the influence of the slipstream on wing-body combination and a determination of the net effect of slipstream on the tail moments proper. A theoretical calculation given indicated that changes in wing moments can be approximated with good agreement but the effect on the tail, although supplying a trend, qualitatively is not yet satisfactory.





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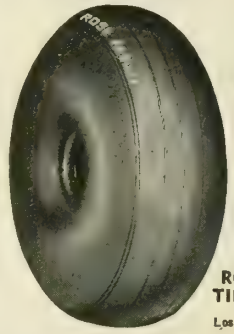
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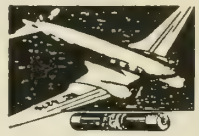
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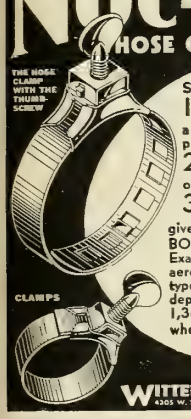
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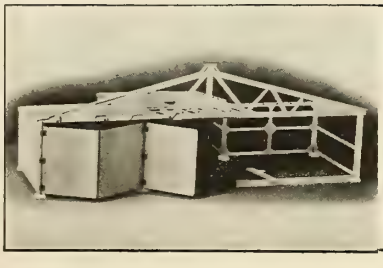
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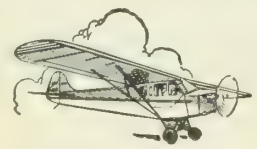
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EAGLET: Szekely '35. Licensed to September 1937. Plane completely recovered. Motor just majored. New Airwheels. Spare motor and propeller. Price, $495. Bayside Airport, Hingham, Massachusetts.

## Beech

BEECHCRAFT B-17-L: In excellent condition, with Jacobs 225 hp, major overhauled and modernized at 256 hours, with new cylinders and crankcase. Total time now 322 hours. Fabric just like new. Color is red with black striping. Hangared at North Beach Airport, New York City. Extras include Curtiss metal propeller, RCA radio receiver, landing lights, three flares, Pioneer clock, synthetic leather upholstery and side walls, thermocouple and the following brand new instruments: shock-proof instrument panel, turn and bank, self-contained rate of climb, 941 Pioneer compass, directional gyro with ball bank and light, Kollsman sensitive altimeter, rotable air speed indicator, manifold pressure, outside air temperature, carburetor temperature and air time recorder, motor cover, tools and stakes. Rock bottom price, $4,950. AERO DIGEST, Box 2533.

BEECHCRAFT C-17-B: Jacobs 285; privately owned, never damaged. Total time 75 hours; only 3 months old. Equipment other than standard: Landing lights, flares, RCA radio, bonded and shielded, Laidlaw upholstery, and special hand-rubbed Loening yellow finish. Reason for selling: owner buying larger airplane. Trades accepted, or best bargain for cash. D. H. Wallace, Hillcrest Road, Santa Barbara, California.

BEECHCRAFT B-17-L: Jacobs 225. 30 hours on motor since factory rebuilt. Ship throughout excellent condition. Licensed to January 15, 1938. Complete blind and night flying equipment, Sperry directional gyro, Kollsman sensitive altimeter, RCA radio and special leather upholstery. Color, red and cream. Bargain, $5,500. Thomas Davis, Airport, Atlantic City, New Jersey.

BEECHCRAFT B-17-L: Privately owned, never injured. Jacobs 225 hp, total time 270 hours; just completing major overhaul and installing latest type shielding. Fabric like new. Red, black stripes. Regular instruments plus flares, landing lights, clock, metal propeller, Western Electric radio receiver, motor cover, tools, stakes and two practically new Russell chutes. Hangared San Francisco Airport, care Pacific Airmotive. Price, overhauled, $6,500. Licensed to April 1937. E. S. McCurdy, Mills Building, San Francisco, California.

## Bellanca

DAMAGED BELLANCA Pacemaker: Powered with Wright E-type 330 motor. Equipped for night flying. Completely bonded, shielded for radio. Ship now in storage in Utah. Will sell less motor. Trades accepted. Edw. A. Forner, Jackson, Michigan.

## Bird

KINNER BIRD: 3-place, airwheels, duals, steel prop; licensed and clean looking. Can finance. Trades considered. Mid-City Flying Service, Hudson, Ohio.

KINNER BIRD: K-5, front exhaust. 35 hours since complete major. Beautiful all yellow finish, duals, airwheels, lights. Wonderful shape. $1,295; can finance. Wire "Al" Leeward, New Kensington, Pa.

## Buhl

BUHL PUP: A-1 shape; just recovered and relicensed. Always hangared. Best Pup in the East. Price $425. Albany Aircraft, Albany Airport, Albany, New York.

## Cessna

WARNER CESSNA: Licensed until October 1937. A-1 shape. Cash, $850 or will trade on Waco Cabin. Write Craig Baxley, Box 208, Fayetteville, N. C.

CESSNA: 125 Warner; licensed, low hours; semi-airwheels, brakes; good condition. For sale, or trade for light training ship, Cub preferred. A. J. Menard, Spearfish, South Dakota.

CESSNA: 4-place, Warner 125; 55 hours since majored. Recovered two years ago. All new Goodyear tires. Privately owned; licensed to July '37. $1,395; will take 2-place late model trade-in. Hank Duncan, 903 Lincoln, Coffeyville, Kansas. Phone: 1869.

## Command-Aire

CHALLENGER COMMAND-AIRE: Licensed till February 1938. Motor 30 hours since overhaul. Semi-airwheels, brakes, starter, steel prop, extra motor parts. $1,000 or would trade for cabin job. G. Christopher, Fire Station, Pampa, Texas.

## Cub

1934 TAYLOR CUB: A-40-2 Continental motor, no time since major. Ship in good shape. Brand new tires and propeller. Winter enclosure. Excellent performance. Licensed until May 1937. $650 cash. Going, going—George Estabrooke, 12 Prospect Drive, Yonkers, New York.

1935 CUB: 404 hours total time and in A-1 shape. Licensed till June '37. Only run-in time on A40-3 engine since thorough major. Ship never cracked and now reconditioned; new cowling; pyraline, including winter enclosure; shock cord; tail spring assembly; all wheel bearings; heavy stabilizer tie rods; approved carburetor heater. Priced for quick cash sale only. Basil Aviation Co., Somerton Airport, Philadelphia, Pennsylvania.

1936 CUB: 9 months old; factory checked last month. With exhaust carburetor and cabin heater and compass. Yellow and black. Excellent condition. $900; 40% cash. McEnnan Flying Service, Ypsilanti, Michigan.

TAYLOR CUB: J-2 demonstrator. New November 1936. Enclosure and Goodyear wheels. A40-4 engine. Ship like new. Can finance. Write P. O. Box 464, Hempstead, New York.

TAYLOR CUB: Manufactured May 1936. Motor just majored. Excellent condition. $950. A. G. Becker, Pittsburgh-Bettis Airport, Dravosburg, Pennsylvania.

CUB DEMONSTRATORS, 1936, 1937: Like new, $950 up. 1935 Cubs, overhauled and relicensed, $750 up. Eaglet, excellent condition, $550. Other bargains, three-place jobs, cabin planes; can finance. Write us. Bennett Air Service, Hightstown ("Cubtown"), New Jersey.

TAYLOR CUB A-40-3: 19 months old. Enclosure and compass. Never cracked. 400 hours. $775. Always hangared. Alex Janaulis, 903 Blaine Street, Detroit, Michigan.

TAYLOR CUB: New June 1935. Private owner. Few hours. Never damaged. Ship and motor absolutely perfect. A clean Cub that is in wonderful shape, and one that really performs. Don't take my word for it—come and see it for yourself. Location: Charleston Airport. A real buy at $795. R. E. Cauthen, Summerville, South Carolina.

TAYLOR CUB: Brand new, ordered but not delivered. Can furnish as you specify. Will consider your car as part payment, finance balance. I. Walter Sell, 566 Vine Street, Johnstown, Pennsylvania.

## Curtiss Robin

CHALLENGER ROBIN: Steel prop, brakes. Just relicensed. Red and cream. Consider trades. Can finance. Also have Robin parts for sale. Mid-City Flying Service, Hudson, Ohio.

TANK ROBIN: 77 hours since motor new; 50 hours since completely recovered. Always hangared, never cracked. New racing prop, skis, wheels. $825. C. O. Laurie, Warroad, Minnesota.

OXX-6 ROBIN: $300 down; has oleo landing gear, new motor; licensed; will consider cash offer or take light car in trade. Pioneer Aviation, Airport, Syracuse, New York.

CHALLENGER ROBIN: Licensed to November 1937. Curtiss-Reed propeller, tailwheel. Only 81 hours since engine major. $895; $445 down. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

OX ROBIN: Licensed until August. Condition excellent. $450. Robert Carey, 258 Ingleside Street, Holyoke, Massachusetts.

CHALLENGER ROBIN: 185 hp motor, just majored; new air wheels, new upholstery, air starter, steel propeller. Accept light car or airplane in trade. Can finance. Central Air Service, Inc., Grand Rapids, Michigan.

## Curtiss-Wright

CURTISS, JR.: Licensed, new tires, new steel tipped prop and new reinforced steel cylinders. Guaranteed total time, 250 hours. A steal at $350. Eau Claire Airways, Eau Claire, Wisconsin.

CURTISS JUNIOR: $150 down; factory majored, new license. Will consider cash offer or take light car in trade. Call, investigate. Pioneer Aviation, Airport, Syracuse, New York.

## Davis

DAVIS: 85 LeBlond. 190 hours since new. Four hours since complete major. Last Davis built. Full NACA cowling, new high-gloss finish. Perfect condition. $1,195; $500 down. Will take trade. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

## Driggs

DE LUXE DRIGGS: 95 Cirrus; 45 hours since major. Wings refinished, fuselage recovered; safety glass windshields, brakes, dual controls; licensed until September 1937. Sacrifice, $1,100. Raymond Hollander, Municipal Airport, Pontiac, Michigan.

## Eaglerock

EAGLEROCK HISSO: Ship and motor just completely major overhauled, including new covering. $495; $295 down. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

COMET EAGLEROCK: Ship and engine perfect. 80 hours total time on engine. An extremely clean low-priced airplane. $595; $300 down. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

EAGLEROCK: Model A-2, OX-5; excellent condition. Stressed up to 220 hp. Recently recovered. 30 x 5 wheels, Flottorp propeller. Accept late model car on deal. Central Air Service, Inc., Grand Rapids, Michigan.

## Fairchild

EXCELLENT 22: Warner 125 hp; always privately owned. Electric starter, generator, tail wheel, cockpit cover. Only 250 total, and recently overhauled. Viking Flying Boat Company, New Haven, Conn.

FAIRCHILD 22: Rover engine. Never crashed. 15 hours since majored. Licensed until October 15, 1937. Ideal for instruction. $1,000. B. I. Gamble, 1411 Frankford Avenue, Philadelphia, Pennsylvania.

FAIRCHILD 24: Two-place, privately owned. Just relicensed. Late type Warner, enclosed rocker boxes; Sperry horizon, drift indicator, air speed, clock, bank indicator; excellent condition. $1,985. Phone or wire White Flying Service, Caldwell Airport, Caldwell, N. J. Telephone: Caldwell 6-1560.

FAIRCHILD 22: American Cirrus 95. Licensed July 1937. Perfect shape; $1,500. $1,000 cash, balance, ship or late model car. Cullin Downs, Route 1, Vienna, Virginia.

FAIRCHILD KR-31: OX-5; complete set instruments; full airwheels; new mail type windshield. One of the best flying OX jobs ever built. $495, or less with standard wheels. Can finance 50%. John T. Corrodi, Inc., Box 185, Bexley Station, Columbus, Ohio.

J6-9 FAIRCHILD 42: In good condition; motor just majored, gas capacity 105 gallons, airwheels, electric starter, generator, landing lights, bank and turn, rate of climb, airspeed, etc. Price, $1,750. North Central Airways, Inc., Homestead, Florida.

FAIRCHILD FC-2: 5-place cabin, only $300 down. Fully equipped, ring, brakes, etc. Will take OX plane or car in trade. Pioneer Aviation, Airport, Syracuse, New York.

FAIRCHILD 24: Built last August. Equipped with RCA radio. This ship perfect in every respect. An outstanding bargain. $4,375. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

FAIRCHILD "24": Practically new 1936 demonstrator. Substantial reduction. Fokker Amphibion, 575 hp Hornet; 94 hours since major. Also new Hornet cylinder. Weddell & Smith. Fairchild Distributors, City Airport, Detroit, Michigan.

FAIRCHILD CHALLENGER KR-31: OXX-6 motor. Like new in every respect; licensed until November 1937. Priced for quick sale. Lester J. Sipe, Box 118, York, Pennsylvania.

FAIRCHILD 24, 1935: Privately owned, like new; air speed, Kollsman compass, sensitive altimeter, directional gyro, air log, turn and bank, thermocouple, air temperature, clock; ship and motor perfect. $3,995. Phone or wire White Flying Service, Caldwell Airport, Caldwell, New Jersey. Telephone: Caldwell 6-1560.

## Great Lakes

GREAT LAKES: New 2T1A, serial number 249. ATC 228; Goodyear Airwheels, brakes, International orange rubbed dope job; price reasonable. Aircraft Service, Municipal Airport, Cleveland, Ohio.

GREAT LAKES 2T1A: New engine and special equipment: Landing lights, navigation lights, wheel pants, brakes, bank and turn, front cockpit cover and mail type windshields. Condition throughout excellent. $1,200. Can finance 50%. John T. Corrodi, Inc., Box 185, Bexley Station, Columbus, Ohio.

GREAT LAKES 2T1A: Airwheels, military windshields, covering one year old. Four hours since motor overhaul, new heads. $950. Don Walters, Norton Field, Columbus, Ohio.

## Laird

LAIRD: Wright 330. Only 197 hours guaranteed time since new. Beautiful high-gloss finish. Turn and bank, rate of climb, electric starter. $2,975. Will finance or take trade. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

### Lincoln-Paige

LINCOLN PAIGE: Three-place, duals, licensed till August. Fully Millerized OX-5, excellent condition. New prop. Extra instruments. Privately owned. Ideal ship to pile up cheap time. Real bargain at $375. B. F. Hennacy, 3265 Colerain, Cincinnati, Ohio.

LINCOLN PT: Kinner K-5; total time 924 hours. 26 since major. Also Challenger engine, overhauled, no time since; $1,000 for lot. Ship in very good condition. Real bargain. Write or wire. George Arth, 3653 Giles, St Louis, Missouri.

### Lockheed

LOCKHEED VEGA: For long distance or South American commercial work. R license, Wasp C developing 700 hp, 600 gallon tanks or 6 seats and upholstering as desired. Motor no time since major overhaul. Wing 20 hours since recovered. Standard instruments. Paint any color as not assembled. Will trade in flyaway condition for 450 Beechcraft or take cash. Quote offer in letter. R. Nichols, Rye, New York.

### Loening

FOR SALE: Loening Commuter, formerly owned by Pan American Airways. Excellent bargain. $2,000 cash or terms. Licensed until November 1937. Communicate Scenic Airways, Northwood, P. O., West Palm Beach, Florida.

### Luscombe

1936 LUSCOMBE PHANTOM: Purchased from factory in October. Total time, 45 hours. Stearman vermilion, cream trim. Equipped: Magneto ignition, Lux fire extinguisher, latest turn and bank, rate of climb and thermocouple. Special compass-clock. Irving chair chutes and parachute doors. Leather upholstery. RCA radio receiver. Plexiglass equipped throughout. Generator, starter, landing lights, etc. Delivered anywhere in East, complete, $6,500. Will sell without chutes and instruments, if desired. Reason for selling, going abroad. Gustavo S. de Bustamante, Paseo Y19, Nedado, Havana, Cuba.

### Monocoupe

J-5 MONOCOACH: 4 passenger cabin. Excellent condition. Price $1,200. Used only as private ship. Dr. F. W. Minty, Rapid City, South Dakota.

MONOCOUPE: 5 months old, like new. 90 hours total time. Two doors, cabin heater. $3,375. Phone or wire White Flying Service, Caldwell Airport, Caldwell, N. J. Phone: Caldwell 6-1560.

VELIE MONOCOUPE: 32-foot wing, split type landing gear, parachute seats. Beautiful red finish. Many extras. Excellent condition. Licensed October 1937. Sacrifice for $495 cash. Henry Awbrey, 220 S. Kansas, Wichita, Kansas.

MONOCOUPE: 90-A, de luxe; black, orange trim; 146 hours, excellent condition; standard instruments, lights and tailwheel. No trades. Will finance. $2,475. C. F. Williams, Miami, Oklahoma.

MONOCOUPE 1935 DE LUXE: Excellent condition. 80 hours since major. Bank and turn, rate of climb; shielded. A. G. Becker, Pittsburgh-Bettis Airport, Dravosburg, Pennsylvania.

LAMBERT MONOCOUPE: 335 hours total time. 73:00 hours on engine since complete major. Airplane recovered and finished in high lustre throughout. Special equipment, left door, engine cowling, wheel pants, tailwheel, special upholstering and clock. $2,050. Can finance 50%. John T. Corrodi, Inc., Box 185 Bexley Station, Columbus, Ohio.

MONOSPORT: 2-place cabin. Warner-powered; $300 down. Pants, ring, turn and bank, new license. Take car or plane in trade. Pioneer Aviation, Airport, Syracuse, New York.

MONOCOUPE: Warner 125. Just relicensed to January 1938. Fabric excellent. Steel propeller. Cruises 120. $1,395; $700 down. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

MONOCOACH: Just repainted, licensed to September 1937. Wright E motor, good photograph ship. Will consider trade for training ship in good condition. Walter C. Heaton, County Airport, Pittsburgh, Pennsylvania.

MONOCOUPE: Powered with Warner Super-Scarab 145 motor. Time less than 200 hours since new. Equioped for night flying. Bonded shielded for radio. Radio receiver installed. Tunnel cowling. Very clean. Becker-Forner Flying Service, Inc., Jackson, Michigan.

FOR SALE: Late model D-145 Monocoupe, powered with 145 hp Warner motor. Equipped for night flying, also radio equipped. Built to cruise 140 mph. Top 160. Well streamlined. Price, $2,850. AERO DIGEST Box 2544.

1936 DE LUXE LAMBERT Monocoupe: 180 hours; starter and battery; high gloss Waco vermilion finish; no time since overhaul. $2,475. Ship has wide landing gear and two doors. 1934 de luxe Lambert Monocoupe: 190 hours; no time since overhaul; $1,850. Waco Distributors, Inc., R. I. State Airport, Hillsgrove, R. I.

VELIE MONOCOUPE: Just relicensed. Fabric and motor good condition. $395. Lycoming motor R-680: Complete, recently majored; bargain at $350. Carthage Airways, Carthage, Missouri.

### Moth

DH MOTH: Completely overhauled, recovered. Extra tank, lights, compass, other extras. Many new parts. Delivered anywhere, expenses only. Ahlers, Hangar 7, Roosevelt Field, Mineola, N. Y.

### N-B Trainer

BARLING NB-3: Powered Genet engine. Engine just majored, airplane completely recovered, reupholstered, just relicensed three-place. Excellent for training and passenger work. $795; $397.50 down. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

### New Standard

D-25 NEW STANDARD: J-5 motor, 52 hours since major. Very smooth motor, steel prop, navigation lights, wired for landing lights. Licensed. Excellent condition. $1,350. Can finance $1,350. Wire "Al" Leeward, New Kensington, Pennsylvania.

### Pitcairn

FOR SALE: Finest J6-7 Pitcairn in the country. Like new. Beautiful finish. Equipped for night flying. Radio, tail wheel, electric starter, semi-airwheels. Also instruments in front cockpit. Automatic fire extinguisher. Reasonable price, $2,500. S. Cavalier, Atlantic City Airport, Atlantic City, New Jersey.

### Porterfield

1936 PORTERFIELD LE BLOND 70 Demonstrator: 10 months old; air speed indicator, speed ring, perfect condition. Price, $1,400. John H. Hoffman, 1323 Astruria Ave., Coral Gables, Florida.

1936 PORTERFIELD demonstrator: Licensed to March 15, 1938. Brakes, tail wheel, speed ring, compass, airspeed. Like new. $1,475. Donald Hood, LaFleur Airport, Northampton, Massachusetts.

### Rearwin

REARWIN SPORTSTER: Model 7000; new August 16, 1936. Good as new. $300 extra equipment. A real buy at $2,150. Indiana Air Service, Bendix Field, South Bend, Indiana.

1936 REARWIN SPORTSTER: 85 LeBlond; little time. For sale or will add cash on trade for Beechcraft. Waco or Stinson. Need larger ship. AERO DIGEST, Box 2526.

REARWIN SPORTSTER 70: Brakes, bank indicator, pitch indicator, speed ring, carburetor heater, Kollsman compass, air speed. Total time less than 75 hours. Excellent condition. No trades. Price, $1,850, flyaway Clarksburg, West Virginia.

### Ryan

FOR SALE: B-5 Ryan, modernized V-6-9. Excellent condition throughout. Landing lights, turn and bank, compass, inertia starter. 135 hours on motor since major. Box 1217, Tampa, Florida.

RYAN LOW WING airplane: Cirrus motor; identified. Will send picture on request. $300 or trade for Heath or any light ship. F. M. Teston, Avondale, Savannah, Georgia.

RYAN SPEEDSTER J6-5: Three-place, open cockpit, dual controls. 150 hours total time on plane. Wonderful shape. $1,500 cash. 5032 Hurlbut Avenue, Detroit, Michigan.

### Sikorsky

SIKORSKY S-39: Equipped with Westinghouse 4-band radio, Grimes retractable landing lights, electric release flares, Sperry horizon, all standard flight instruments, generator, large battery and extra gas tanks. Only 13 hours since complete major on motor and ship. Total time, 510 hours. Just relicensed. Bargain for cash. Louis S Purchase, Miami Municipal Airport, Miami, Florida.

### Stearman

STEARMAN C-3-R: J-6 300 hp. Excellent condition, full instrument equipment. Plane reconditioned, motor just overhauled. Quick sale, $1,600. Aircraft Service, Municipal Airport, Cleveland, Ohio.

### Stinson

STINSON 1936: Wright 285 powered. Hamilton controllable prop. Full set of instruments, radio, electric flare, and special paint job (black and dark green). The ship the same as new. Just a few months since it left the factory. Substantial discount. Greeley Air Service, Stinson Distributors, 1901 Monaco Parkway, Denver, Colorado.

STINSON SR-6: Smith controllable, special high gloss finish on wings the same as on the fuselage, generator, landing lights, leather upholstery, 75 gallons gas, the big Kollsman compass, thermocouple, turn and bank, rate of climb and vacuum flaps. This ship is a real buy; looks like new. $5,500. AERO DIGEST, Box 2536.

STINSON MODEL W: Wasp Jr., just topped. Ship and motor in excellent condition throughout. Electric inertia starter, bank and turn, rate of climb, clock, thermocouple; both gravity and fuel pressure systems; late type carburetor; fenders. Price, $2,250. Phone or wire White Flying Service, Caldwell Airport, Caldwell, New Jersey. Telephone: Caldwell 6-1560.

STINSON 1934 RELIANT: One owner, perfect condition, fully equipped; landing lights, flares, radio, bank and turn, rate of climb, clock, generator, dual control wheel; total time 350 hours. Price, $3,500. Wings Field, Inc., Ambler, Pennsylvania.

FOR SALE: Stinson Reliant SR-6, slightly damaged in crack-up. Fuselage easily repairable, left wing can be rebuilt. Rest of ship not scratched. Less motor, prop and instruments. Robinson Air Service, Inc., Municipal Airport, Rochester, New York.

STINSON RELIANT: Late '33 model. 72-gallon tanks; 5 electric flares; retractable landing lights; neat looking, excellent condition. $2,375. Kenneth Wright, Bernard Airport, Youngstown, Ohio.

STINSON SM8A: Late type landing gear, factory modernized motor. Excellent finish. Priced to sell. Write for photo and information. A. G. Becker, Pittsburgh-Bettis Airport, Dravosburg, Penna.

LYCOMING STINSON: $600 down. Airwheels, fully equipped; will take trade. Perfect condition; a smart buyer will call or wire for option. Pioneer Aviation. Airport, Syracuse, New York.

J6-7 STINSON: Just completely recovered and newly upholstered. Engine just majored and modernized. An unusual buy in an airplane in perfect condition. $1,495; $875 down. Will take trade. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

TRIMOTORED STINSON Airliner: Complete night and blind flying equipment. Radio, electric starters. Licensed to August 1937. $2,650. Will finance or take trade. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

1936 STINSON SR-7B: Long range model. Gunmetal gray and white. Privately owned, never damaged, carefully flown and maintained. Controllable pitch propeller, RCA radio, Kollsman altimeter and compass, Pioneer bank-turn, climb indicator and airspeed; plus manifold pressure gauge. Carburetor air temperature gauge and thermocouple. Special blue leather furnishings. Lycoming 245 hp (R-680-B6), used only 120 hours. $6,190. Dr. Edwin G. Bovill, 9203 Grand River, Detroit, Michigan.

WARNER STINSON: Licensed, Hamilton steel prop, navigation lights, landing lights, storage battery, bank, turn, climb indicators, airspeed, heater, compass, brakes, tail wheel. Wing recovered. $795. Terms arranged. Dick Ferry, Stockbridge, Mass.

STINSON 1934: SR-5 with flaps. Total time, 300 hours. Privately owned. Olive with orange stripe. Turn and bank, rate of climb, radio, navigation and landing lights, compass. Like new, never cracked. $3,600. Will finance. Dr. Harold W. Trott, Hemlock, New York.

STINSON RELIANT: '33 model, completely bonded, shielded for radio. Radio receiver installed. Also fully equipped for night flying. Excellent condition. Terms. Edward A. Forner, Jackson, Michigan.

2 SM1F STINSONS: Six-place, 330 hp Wright D motors, recently majored. A-1 condition throughout. Large load capacity and moneymakers for barnstormers. Air wheels. Trade in your airplane or light car. Priced to sell. Terms. Central Air Service, Inc., Grand Rapids, Michigan.

STINSON SM1F: 6-place, serial number 501. Sell or trade for smaller ship. Licensed October 15, 1937. Supercharged Wright 330 hp. Beautiful ship; condition A-1. Zannie Burch, 4754 Milford Avenue, Detroit, Michigan.

1935 SR-6 STINSON Reliant: NC15129; never damaged. Always hangared. Flown by private owner exclusively. Total time, ship and motor, 210 hours. Additional equipment: Kollsman sensitive altimeter, bank and turn, rate of climb, trip recording clock, landing lights, flares and RCA radio. Cash sale, no trades. $4,800. John Carroll, Aviation Department, Standard Oil Company of New Jersey, 26 Broadway, New York, N. Y.

BARGAINS IN USED Stinson "S" models: Good condition throughout, many extra instruments, $1,500 to $1,700. 1934 Model, 450 hours total time, motor recently majored, Smith propeller, many extras including radio; fabric like new; $5,000. 1935 model, 400 hours total time, motor recently majored, Smith propeller, many extras including radio, $5,000. 1936 model, many extras, like new, $6,000. E. W. Wiggins Airways Inc., Providence, R. I.

FOR SALE: Lycoming 260 hp SR-5C Stinson Reliant. Very complete set of instruments; radio equipped; flaps; complete night flying equipment; controllable propeller. Priced for quick sale. Can finance. Edw. A. Forner, Jackson, Michigan.

## *Travel Air*

J6-5 TRAVEL AIR E-4000: Excellent condition. Recovered last winter. High gloss finish. Engine brand new 290 hours ago. Brakes, duals, steel prop, navigation lights, vertical radio antenna, clock, compass, air speed, radio shielding, hand inertia. Gas capacity for 600 miles. Licensed. Never cracked and definitely in excellent condition throughout. $1,400. Loren Jones, care of Emrick Flying Service, Central Airport, Camden, N. J.

TRAVEL AIR S-6000-B: J6-9 330 hp. 6-7 place. New fabric. Licensed to February 1938. Engine overhauled, "E" pistons and supercharger. Iowa Airways, Fort Dodge, Iowa.

FOR SALE: J6-7 Travel Air Model 4-D. Engine and ship completely overhauled and recovered. Licensed until January 1938. Priced to sell. Felix Blum, Hangar D. Roosevelt Field, Mineola, N. Y.

TRAVEL AIR 4000: J-5 Wright. Just recovered, looks like new. Equipped for skywriting, student instructing or carrying passengers. Also a real ship for crop dusting or banner towing. Priced at $1,400. Harold Neumann, 2714 W. 51st Street, Kansas City, Kansas.

J-5 TRAVEL AIR B-4000: Licensed to next September. Turn and bank, rate of climb, steel propeller, tailwheel. $1,175. Will finance or take trade. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

J-5 TRAVEL AIR: Frieze type ailerons, outrigger undercarriage, steel prop; licensed. A bargain at $875. Louisville Flying Service, Inc., Louisville, Kentucky.

J-5 4000 TRAVEL AIR: New covering, excellent finish, perfect J-5 engine. Lincoln Page, powered with Axelson 115 hp engine; will take late car in trade. 2000 Travel Air, lower wings and landing gear damaged; have mount and oil tank for converting it to 4000 J-5. Kingsville Cabinet Shop, Kingsville, Missouri.

TRAVEL AIR 2000: Privately owned, never changed hands since new. Always hangared. Licensed until July. Must sacrifice for $350. L. V. Webster, 1320 Fourth Ave., Moline, Illinois.

## *Waco*

WACO GXE: 115 hp Tank engine. Engine recently factory majored, ship completely reconditioned. Highest cash offer or take two-place job in trade. Would like Davis or similar ship. Charles J. Farmer, Hangar 2, Buffalo Municipal Airport, Buffalo, New York.

WACO 90 GXE: OXX-6. Identified. Good fabric. Motor majored, 20 hours. Ship flying condition. $200 or trade for cheap Cub. Charles Steckiewicz, Pelham, New Hampshire.

WACO NINE OX-5: Ship just majored; all new covering, paint, etc. Motor excellent, brand new Scintilla. Licensed to October 1937. A dandy performer, $395, cash. Write Kenneth Roney, 218 Chestnut Street, Haddonfield, New Jersey.

WACO CABIN: July 1936; Jacobs 225, steel prop. Blue finish, red trim, de luxe upholstery, seats, control column, etc. 70 gallons gas; heater, thermocouple, bank and turn, rate of climb. Westport radio, air brakes, 3½ minute flares, landing lights, Kollsman altimeter; 100 hours total. Perfect condition. Best over $5,000. J. Steinel, 523 Flynn Building, Des Moines, Iowa.

WARNER WACO F: Newly majored and covered. In perfect shape. $1,350. Witch Duck Aeroplane Corporation, 248 Bank Street, Norfolk, Virginia.

FOR SALE: Straightwing Waco, J6-5 Wright, majored, modernized 52 hours ago by Wright company. Steel prop, starter, semi-airwheels, brakes, Aerol landing gear, lights, booster; fuselage and tail assembly just recovered. Licensed August 1937. Will take in trade straightwing Waco with J-5 motor only, and must be in A-1 shape. Want to make deal immediately. Nicholas Myers, Airport, Atlantic City, New Jersey.

SALE OR EXCHANGE: Waco cabin, new type Continental 210; year old. Covering year old. Equipped for blind flying. Heywood starter, generator, landing lights and five-minute flare. Radio. Have an Eaglerock OX-5, $250 and OXX-6 motor with two Scintillas, Miller overhead, $80. Also Hisso Command-Aire, $250. John Stover, Airport, Hot Springs, Arkansas.

WACO CABIN: 1934. Modernized Continental, lights, flares, radio and other special equipment. Ship and engine in wonderful shape and priced reasonably. For more details, write Wings Field, Inc., Ambler, Pennsylvania.

1936 WACO CUSTOM CABIN: Wright 285 R-760-E-1, Hamilton controllable pitch propeller; 204 hours total time; color blue and gray; beautifully upholstered; ship like new. Original cost over $11,000. Standard instruments plus Kollsman compass, Kollsman sensitive altimeter, bank and turn, rate of climb, manifold pressure, elapsed time clock, thermocouple. Western Electric radio, vacuum operated flaps, landing lights, three 1½ minute flares. Price, $6,200. Fort Smith Airways, Fort Smith, Arkansas.

WACO BSO: J6-5; 3-place; engine majored and modernized 175 hp. Recently recovered. Perfect condition. Color, black and gold. Must sell. Ringel Flying Service, 917 Bigelow, Peoria, Illinois.

WACO GXE: Licensed to January 1938. New Scintilla magnetos. Fabric perfect. $475; $275 down. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

WACO F: Warner powered. Ten hours on engine since major. Licensed to next September. A real buy. $1,295. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

WACO CUSTOM CABIN: Jacobs 225 hp. Demonstrator. Wonderful condition. Extras include: Bank and turn, rate of climb, RCA receiver, lights, flares, 70-gallon gas tanks. Cost over $7,700. Must sell to make room for new models. Must be seen to be appreciated. Priced to sell quick. The H. C. Robbins Company, Waco Distributors, Cleveland Airport, Cleveland, Ohio.

WACO, MILLERIZED: Now being recovered; completely refinished with best materials. $385. $100 deposit will hold till May 1937. Waynedale Airport, Route 4, Fort Wayne, Indiana.

WACO CABIN: Built September 1933. Motor factory majored, ship in perfect condition. Price, $2,200. Arthur E. Lamparter, Lancaster Airport, Lancaster, Pennsylvania.

WACO CABIN: Late '32, Continental 210 engine, time 400. 187 since major. Steel propeller, air starter, landing lights, flares, Westport radio, climb and turn indicators, generator, leather upholstery. Ship never damaged; absolutely A-1 condition; excellent appearance. $2,150 cash. Don Odom, 4105 Garrott, Houston, Texas.

WACO A: Late '32. 170 Jacobs. Radio, starter, turn and bank, landing lights, winter enclosure, excellent finish and covering. $1,700. Consider trade good three-place open. Lytle, 2333 Vodeli Street, Pittsburgh, Pennsylvania.

WACO GXE: Tank No. 63 engine. Excellent condition. 494 hours total time. Engine 300 hours. $700. Demorr Aeronautical Corp., Main Line Airport, Paoli, Pennsylvania.

WACO 1936 CUSTOM CABIN: 285 Jacobs, Curtiss-Reed propeller; fully equipped, landing lights, flares, radio, bank and turn, rate of climb, clock, thermocouple, manifold pressure gauge, wheel pants, dual control wheels; total time 247 hours, one hour since top overhaul. Price, $6,000. Wings Field, Inc., Ambler, Pennsylvania.

WACO F: Kinner K-5. Just relicensed. 80 hours since major on engine. An excellent and economical passenger-carrying ship. $1,195. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

WACO 1934 CABIN: Jacobs 225. Less than 300 hours. Motor converted and majored. Radio, lights, flares, bank and turn, rate of climb, 70-gallons gas capacity, outside temperature, thermocouple, Jaeger chronoflite clock. Must sell quick, therefore real bargain. Condition extra good. The H. C. Robbins Co., Waco Distributors, Cleveland Airport, Cleveland, Ohio.

WACO 10: Completely overhauled. New covering throughout. Motor major overhauled. Relicensed for a year. Price, $395. Bayside Flying Service, Inc., Hingham, Mass.

1935 WACO CUSTOM CABIN: With 285 Wright and Hamilton Standard controllable pitch propeller; 250 hours; perfect condition; all standard instruments plus directional gyro, bank and turn, rate of climb, sensitive altimeter, manifold pressure, clock, outside air and head temperature gauges; RCA receiver; landing light; flares; and 95-gallon gas capacity; beautifully upholstered with the finest Goodall-Sanford plush. Price, $5,900. Goodall Company, Cincinnati, Ohio.

WACO CABIN 1933: Continental 210 engine. Extras include: Lear radio, bank and turn, rate of climb, airbrakes, landing lights, electric starter, generator and generator control box. Fuselage just recovered. Condition extra good. Very reasonable. Ray Hylan, Municipal Airport, Rochester, New York.

J-5 WACO: Straightwing; outrigger undercarriage, steel prop, high polish finish, fabric excellent, motor only five hours since complete overhaul; $1,175. Louisville Flying Service, Inc., Louisville, Ky.

WACO C: Late 1931. Continental 165 hp, motor majored 140 hours ago. Topped 40 hours. Recover work just completed. New compass, semi-airwheels, navigating and landing lights. $1,750. Will finance. Aviation Finance Co., Hemlock, New York.

FOR SALE: 1935 Custom Waco Cabin, 5-place; 285 Jacobs. 75 hours since factory major. Radio, landing and navigation lights, special paint; privately owned. 95-gallon tanks, tail wheel lock, pants, steel prop; licensed until December 1937. Will accept trade. $4,300. C. Mantaras, 704 East 43rd Street, Brooklyn, N. Y. Telephone: Buckminster 4-4942.

WACO GXE: OX-5. Engine only 30 hours since top overhaul. Licensed till September 1937. For quick sale, $375. D. Shafor, 191 Millville Avenue, Hamilton, Ohio.

WACO CSO: Wright 250 motor, Heywood starter, all instruments; equipped with both wheels and Edo floats, retractable rudders. Ship, motor and floats in top condition. Write or wire Murray Alderman, care Roy Furniture Co., Syracuse, New York.

WACO F-2: Continental 165; beautiful high lustre finish; complete airplane perfect condition throughout. Total time on ship, 510 hours; engine, 560 hours. Time since complete major overhaul, 70 hours. John T. Corrodi, Inc., Box 185, Bexley Station, Columbus, Ohio.

WACO GXE: Fabric, ship, tires good. OX turns 1530. Only 60 hours since major. Performs excellently at our 7000-foot port. $300. E. A. Utz, 417 San Antonio Street, Santa Fe, New Mexico.

WACO UBA: 210 Continental; 2-place sport; Heywood starter, ring, tail wheel, bank and rate of climb. Cash deal. Ship and motor excellent condition. AERO DIGEST, Box 2550.

WACO 1935 CUSTOM MODEL: 225 Jacobs, recently top overhauled and shielded at factory; total time 200 hours; like new. Kollsman sensitive altimeter, artificial horizon, thermocouple, clock, landing lights; $4,750. E. W. Wiggins Airways, Inc., Providence, Rhode Island.

WACO GXE: Fuselage recovered, air wheels, compass, air speed; engine A-1. $450. Will take motorcycle as part payment. Earl Howard, 1115 State Street, Cedar Falls, Iowa.

WACO BSO: Straightwing; J6-5 motor, 540 hours total time; motor just overhauled, ship recovered last year; $1,000. Waco F-3, 225 Jacobs motor, 300 hours total time; motor modernized and overhauled; many extras, ship like new; cruises at 135 mph. $3,000. E. W. Wiggins Airways, Inc., Providence, Rhode Island.

WACO CUSTOM CABIN: Wright 285 hp. Extras include Hamilton Standard controllable propeller, generator, bank and turn, rate of climb, lights, flares, RCA radio receiver, RCA transmitter, leather upholstering, wheel pants, thermocouple, finished in white fuselage, red wings, trimmed in blue. Very attractive. Good condition throughout. Has had best of care. Just traded in on new C-7 Waco. Only $4,995. A real bargain. The H. C. Robbins Co., Waco Distributors, Cleveland Airport, Cleveland, Ohio.

WACO CUSTOM CABIN: With 225 Jacobs; total time less than 200 hours; motor just topped at factory; ship cannot be told from new. Write for details and price. Wings Field, Inc., Ambler, Pa.

## *Special Jobs*

SPORT MONOPLANE: Model A powered, now flying, good condition, skis, wheels, $150. Deliver reasonable distance for expenses. Sam Kelsey, 3721 Brunswick, St. Louis Park, Minnesota.

HOWARD RACER: 200 mph. Just the plane for sport, racing or stunt flying. A real buy at $1,100. Harold Neumann, 2714 W. 51st Street, Kansas City, Kansas.

WACO 10: Just relicensed. Ship and motor good. $398; will trade on late Cub and give cash difference. Ralph Walcutt, Syracuse, Ohio.

WACO LEACH: Continental 165, airwheels, brakes, starter, metal propeller, duals; covering and engine in excellent shape. Unlicensed, due to some changes. First $400 cash, flyaway. Leonard Lein, 2900 West Lapham Street, Milwaukee, Wisconsin.

TWO-PLACE IDENTIFIED monoplane: 90 hp LeBlond powered; flown 10 hours. Weight, 920 lb. Make offer. Raymond A. Munson, 1628 North Franklin Place, Milwaukee, Wisconsin.

AERONCA-POWERED Midwing racer: 100 mph top. Single-place, identified; airwheels; Clark Y wings. Never cracked; flying condition. Will trade for '33 auto, licensed ship. Altoona Airport, Duncansville, Pennsylvania.

## *Miscellaneous Aircraft*

FOR SALE: Davis D-1, $800; C-3 Aeronca '34, $800; two Great Lakes 2T1A, each $900. The above ships are in excellent condition. Ann Arbor Air Service, Municipal Airport, Ann Arbor, Michigan.

OX-5 SWALLOW: Licensed, airwheels, duals; in A-1 shape. Bargain at $325. OX-5 Command-Aire, $275. Avro-Avian, $565. Aeronca low wing, $1,950. Mid-City Flying Service, Hudson, Ohio.

SALE OR EXCHANGE: Waco cabin, new type Continental 210; year old. Covering year old. Equipped for blind flying. Heywood starter, generator, landing lights and five-minute flare. Radio. Have an Eaglerock OX-5, $250 and OXX-6 motor with two Scintillas, Miller overhead, $60. Also Hisso Command-Aire, $250. John Stover, Airport, Hot Springs, Arkansas.

1936 MODEL C-34 CESSNA Demonstrator: Special paint and upholstery. Plane is like new and carries factory guarantee. Kinner Playboy: 160 hp motor. Total time 220 hours. Ship and motor like new. Will trade; big bargain. 125 hp Warner Monocoupe: Semi-airwheels, steel propeller, electric starter, shielding and bonding and radio. Motor just overhauled. Beautiful ship; big bargain. Model SM8A Stinson: Ship and motor in best of condition. Price, $1,295. Challenger Travel Air: Perfect condition, $1,250. J6-7 Beechcraft: Has had very best of care. Gyro and complete blind flying equipment. Ship cost over $15,000. Our price, $6,500. Will consider trade on late model used automobiles or other airplanes. Cessna Aircraft Company, Wichita, Kans.

CRACKED REARWIN JR.: $100; Arrow Sport, $550; American Eagle, $400; Travel Air, $250; Eaglet, $450. Motors: LeBlond 65, $150; LeBlond 90, $200. Propellers: OX-5, $20; LeBlond, $18; Szekely, $15. Scintilla mags: J-5, $20; LeBlond, $15. Retz Aero Shop, Farmland, Indiana.

SPARTAN LOW WING: Jacobs 55, majored and relicensed, $900. Travel Air 2000, OX-5, bolted mount, $475. Cub E-2, $750. New Cub, four months old, $1,085. Foster A. Lane, Port Columbus, Columbus, Ohio.

PRIVATE J6-5 TRAVEL AIR, Waco F, Great Lakes, $500 down. Stinson Reliant, Beechcraft, Waco F-2, $1,000 down. Taylor Cubs, Aeroncas, $250 down. OX planes, $150 down. Write Pioneer Aero Brokerage, Airport, Syracuse, New York.

FLEET, WARNER: In A-1 shape. Sacrifice for $895. Fairchild KR-31, Millerized OXX-6, majored, ship excellent, $450. Bob Mostoller, 259 East Patriot Street, Somerset, Penna.

FOR SALE OR TRADE: Kitty Hawk, $500; Bird, $850; Hess Argo, $785; Great Lakes, $825; Challenger Command-Aire, $1,000; Challenger Travel Air, $1,000; Cabin Waco UIC with radio, lights, flares, ambulance, $3,200; Wasp, J-5 and Challenger motor parts. Terms as low as one-third down. Airways, Inc., Waterville Municipal Airport, Waterville, Maine.

VELIE MONOCOUPE: $250. OX Swallow TP, just relicensed, $325. Kinner Bird, $950. Challenger Robin, $1,050. 1937 Cub, 10 hours, $1,250. AERO DIGEST, Box 2543.

STINSON LYCOMING: Built June 1936; 150 hours total; many extras. Will sell at price. Also overhauled Kinner 125 hp Waco F. $1,400. J-5 Travel Air. $1,050. Meinke-Eldred Flying Service, Inc., Willoughby, Ohio.

SPORTPLANES: $50 up. OX jobs, $100 up. Hundreds of others. Terms. Complete Directory with owner's price, name and address. 25c postpaid. Used Aircraft Directory, Athens, Ohio.

WACO F WARNER: Stinson Jr., J-5 engine, overhauled and recovered; Rover Driggs; 1935 Aeronca. All ships licensed and in excellent condition. Air Activities Airport, West Chicago, Illinois.

FOR SALE: Buhl Pup, perfect condition. Motor factory majored; $485. Curtiss-Wright Junior: Less than 250 hours total time; $385. Rearwin 7000. LeBlond 70: Motor just majored, navigation light and Grimes landing lights; $1,450. Ten other airplanes available for sale or trade. Cash or can be financed. DePonti Aviation Co., Municipal Airport, Minneapolis, Minnesota.

REPOSSESSED CUBS, Ryan B-1, Wallace, Waco C, Kinner Bird, Aeroncas, OX Eaglerock, Cunningham-Hall and 1934 Stinson airplanes. Continental A-40-2, Cirrus Mark III and II, Salmson 9-cylinder and Lycoming motors, just majored. Airplane parts for Stinson Reliant, Moths, Avians, Cubs, Klemms and American Eagles. Also 16-stud Kinner cylinders and steel propellers and parts. Airplanes sold small down payment, balance monthly. Parts and motors completely financed. Aviation Finance Co., Hemlock, New York.

20 CERTIFIED AIRPLANES for sale or exchange: J-4 220 hp Straightwing Waco; Warner 145 hp Monocoupe, late model; J-5 Speedwing Travel Air; B-5 330 hp 6-place Ryan; J-5 220 hp 3-place Laird; J6-9 330 hp 6-place Stinson; PA-8 Pitcairn Mailwing, less 330 hp motor; 2 OX-5 Waco 90's; 2 OX-5 Travel Airs; Lycoming-powered Stinson Jr., equipped for night flying, includes radio; J6-7 250 hp 3-place Travel Air; J6-9 330 hp 6-place Travel Air; OX-5 Robin; J-5 6-place Stinson; OX-5 Laird; J-5 220 hp Straightwing Waco. Late model cars accepted. Deals financed. Becker-Forner Flying Service, Inc., Jackson, Michigan.

BUY NOW:15 excellent airplanes: Two Wright J6-9 Stinsons, 6-place. Two Driggs Skylarks, one nearly new. Two J-5 Travel Airs, J-5 Waco, Lambert-powered Cavalier Coupe, Challenger Robin, air starter, new airwheels. Taylor Cub, Aeronca C-3, Waco OX recently reconditioned, two OX Travel Airs, OX Eaglerock, stressed for J-5. Trade in your car or airplane. Can finance. Write for details. Central Air Service, Inc., Grand Rapids, Michigan.

'34 WACO CABIN, Jacobs; '34 Stinson Reliant; 225 Jacobs Beechcraft; '36 Lambert Monocoupe; '35 3-place Warner Fairchild; Bellanca Skyrocket; Rearwin Sportster, new, 85 LeBlond; J6-7 Travel Air; Stinson SM8A. Aircraft Sales Company, Hangar D, Roosevelt Field, Mineola, N. Y.

FOR SALE: Stinson U trimotor, formerly American Airlines; price, $2,500. Also, 1934 Stinson single motor with flaps, flares, radio, directional gyro, artificial horizon and Hamilton controllable pitch propeller. 15 hours since major overhaul; price, $3,400. One Hamilton 7-place all metal airplane, ship and motor just major overhauled. Price for one Lycoming 240 hp motor, completely overhauled, $1,000. Bluebird Air Service, Municipal Airport, Chicago, Illinois.

1936 WACO CABIN: Jacobs; radio, flares, extras; 60 hours total time. K-5 Bird, recently overhauled. 1935 Aeronca C-3. Accept trades or finance 50%. Bishop Flying Service, Inc., Bishop Airport, Flint, Michigan.

PLANES FOR SALE: Laird Speedwing, Wright 330; Laird Whirlwind, Wright J-6 300; Laird Whirlwind, Wright J-5 220; Laird Speedwing Jr., Ranger 120; Buhl 2-place trainer, Wright J-5. Send for complete list of used planes. E. M. Laird Airplane Company, 5917 South Cicero Avenue, Chicago, Ill.

1932 HEATH: Excellent condition; 225 hours; $325. 1929 model 90 OX-5 Waco, good condition; $465. Simplex Kinner-powered monoplane, side-by-side; $650. 1934 Stinson Reliant, $2,750. Terms, trades. Neil R. McCray, Erie County Airport, Fairview, Pa.

J-5 FORD: Only 40 hours since engines were major overhauled at Parks Air College. J-5 Standard; J-5 Eaglerock. Cracked-up Standard. Lots J-5 parts. Write or wire Joe Muleh, 225 East Lee Street, Greensboro, North Carolina.

J-5 STINSON DETROITER: Licensed to March 1938. Motor just majored; speed ring, Bendix wheels and wicker chairs; $900. Tank-powered Waco GXE: New Fahlin propeller, lights, licensed to March 1938; $700. Ships delivered within 600 miles. Hinz Bros. Air Service, Abilene, Kansas.

CURTISS-WRIGHT Travel Air Sport: J6-5 E series. Almost like new. Many extras, including electric starter. $1,500 or, equipped with floats, $2,000. Also, Spartan Low Wings, $700. E. W. Wiggins Airways, Inc., Providence, Rhode Island.

## ENGINES

FOR SALE: £65 each, British R.A.F. surplus. A large number of Armstrong-Siddeley "Mongoose", five-cylinder, left hand tractor, air-cooled radial aero motors. 150 hp at 2035 revolutions. 320 lbs. weight. Complete with dual magneto ignition, carbureter and air intake, propeller hub and bolts, oil pumps and piping. Ready for installation. Packed F.O.B. London docks. Many other higher and lower powered motors for disposal. L. Anderson, Bristow Road, Hounslow, Middlesex, England.

MOTORS! MOTORS! MOTORS! 2 J6-9 E-Type 330 hp motors; 2 J-4 220 hp motors; J6-5 175 hp motor; 2 J6-9 330 D-type motors; J6-7 250 hp D-type motor; LeBlond 70 hp motor, just majored; J-5 220 hp motor. These motors are all in running condition and priced to sell. Starters and propellers for above motors if desired. Also a slew of motor and aircraft parts at closing-out prices. Michigan Aero Motors, Jackson, Michigan.

FOR SALE: J-5 motor and its Hamilton Standard steel propeller, $195. J6-5 Challenger upper wings, center section and tail surfaces, all covered, $95. Bayside Airport, Hingham, Massachusetts.

LYCOMING R-680-BA: 240 hp; completely overhauled and tested; equipped with direct starter and adjustable pitch propeller. $1,000. General Airmotive Corp., Municipal Airport, Cleveland, Ohio.

## MISCELLANEOUS PRODUCTS AND EQUIPMENT

MIDWINTER SALE of wings: Waco, Travel Air, Swallow, Aeronca, Monoprep. Trade your wrecked wings for these rebuilt licensed wings. N. L. Aircraft Co., Vermilion, Ohio.

COMPARE MY PRICES before you buy: Stop playing sap . . . start saving money—on brand new aviation parts, clothing, equipment, helmets, instruments, tools, goggles, everything you need. 40% to 60% off list prices. Nationally known stuff. Established firm. Get my amazing bargain catalog by sending one dime (Canada 20c) which I return with your first order. Karl Ort, 610 W. Poplar St., York, Pa.

COMPLETE STOCK inspected J-5 parts. Also K-5 parts. Write for list of carefully maintained trade-in planes. Some being major overhauled in our government approved shop. Can be painted any color. Walz Corporation, Central Airport, Camden, N. J.

FOR SALE: Tail units, landing gear parts, for Travel Air, Bull Pup, Fleet. Stinson wings, ailerons. Standard steel propellers, hubs and parts. Irving parachute. Valve refacer; Velie Monocoupe. Cameras, etc. Box 1457, Tampa, Florida.

FOR SALE: Used J6-7 speed ring, $20. Used J6-9 exhaust manifold, $12. Used Kinner exhaust manifold, $15. Link Trainer, $250. Engel Aircraft Specialties, Escondido, California.

FOR SALE: Camera; Watson aerial 5 x 7, with 10" F:6.8 Demaria lens, standard Graflex back, film pack adapter. Price $119. AERO DIGEST, Box 2529.

FOLLOWING BRAND NEW equipment, that has never been used or installed: Pioneer tachometer, $10; oil temperature thermometer, $5; Western Electric radio receiver, $50. Also reconditioned Wasp Jr. magneto, $10. AERO DIGEST, Box 2534.

VERVILLE CABIN J6-7: Just majored, perfectly clean; night equipment. Outperforms SM8A. Steal, $1,095. Trades. Extra majored J6-7, $450. Semi-airwheels, 850 x 10, brakes, $60. Tail airwheel, shock assembly, Stinson Detroiter, $20. Warner parts. Instruments: Turn, $45; climb, $45. Buck, Stratford Apartments, Madison, Wisc.

FOR SALE: Wright J-5 set of 9 reconditioned complete cylinder assemblies (rebored plus .010), with new pistons and rings. Price, $295. Includes new exhaust seats, guides, rocker bushings, rocker rollers, perfect valves and overhead, cylinders sandblasted and baked enameled, serviced ready to fly. Air-Parts, Inc., Glendale, California.

"FLIGHTEX" sewn-up, slip-on covers for all airplanes. Get our quotations for your airplane's covers. Wanted: Challenger biplane, condition secondary, if licenseable. Ostergaard Aircraft, Dunning, Chicago, Illinois.

BROTHER, CAN YOU SPARE a dime? If you can, send it to me and I'll send you my Low-Priced Aviation Material Catalog. (Canada 20c). Karl Ort, 625 W. Poplar, York, Pennsylvania.

STINSON TRIMOTOR U and T parts; Pilgrim parts; Hamilton Standard adjustable propellers and hubs, 165 hp and up; Great Lakes trainer wood propellers; magnetos, carburetors and starters for J-5, J-6, Wasp, Hornet and Cyclone; Wiley three-minute flares; tail wheels and tires; gas and oil tanks; chairs; J-5 cylinders; Wasp and J-6 parts; miscellaneous parts. General Airmotive Corporation, Municipal Airport, Cleveland, Ohio.

AERIAL CAMERA: 5 x 7, Bausch & Lomb 12" lens. Good condition throughout. Complete, $115. Less lens, $45. Monty Barnes, 638 Pattie, Wichita, Kansas.

650 x 10 SEMI-AIRWHEELS, complete, perfect condition, $40 cash at once; also 30 x 5 tires, wheels, brakes, $9; Aeronca C-3 carburetor, complete, $7. J. Slager, 434 Solon Street, Toledo, Ohio.

USED: Wasp Fairchild exhaust ring, $40; J6-9 exhaust manifold, $12; J-5 exhaust ring, without elbows, $15; J6-7 speed rings, $23. Engel Aircraft Specialties, Escondido, Calif.

ENGINES AND PROPELLERS: Wright J-5, $495. Tank Aero model 63 motor, $395. No time on motors since overhaul. J-5 steel propellers, Hamilton wood, $15. We carry Flottorp and Bennett propellers for all motors. Write for details. Central Air Service, Inc., Grand Rapids, Michigan.

HAVE GREAT LAKES 2T1A parts; Waco 10 parts; Waco '31 model cabin landing gear and tail group; Travel Air 12-Q Trainer parts. Kingsville Cabinet Shop, Kingsville, Missouri.

AIRWHEELS: 22x10-4, complete with hubs, tires and tubes. Tires nearly new. Lester J. Sipe, Box 118, York, Pennsylvania.

## PARACHUTES FOR SALE

PARACHUTES: Irving and Switlik chutes, new and used. Wanted at all times used parachutes for cash. Describe fully. Air thrillers for airports, celebrations, etc. Thompson Bros. Balloon & Parachute Co., Aurora, Illinois. Established 1903.

## MISCELLANEOUS SERVICES OPPORTUNITIES, OFFERS, ETC.

COMPLETELY EQUIPPED Flying School and taxi business, established since 1925, hangar, up-to-date machine shop, office, 4 training planes, 2 charter planes, very active; school located within 100 miles of New York City on municipal airport within three miles of city of 150,000 population. Good opportunity for capital investment. AERO DIGEST, Box 2527.

DO YOU FEEL you have a valuable invention—but can't get it before the right people? Are you groping in the dark, wondering which way to turn . . . getting nowhere? Learn how other men with inventions have cashed in. Write for our Free Book, "Patent Guide for the Inventor", which tells you of fields where inventions earn big money if they are patented ones. Clarence A. O'Brien & Hyman Berman, Registered Patent Attorneys, 314-K Adams Bldg., Washington, D. C.

PLAN DEVELOPMENT of protection from chemical warfare in planes, hangars and airports. Major Army Chemical Warfare Reserve. AERO DIGEST, Box 2532.

WANTED: Financing for propeller development possessing outstanding features. Models have undergone exhaustive tests. Financing also desired for motor silencer which removes back pressure and completely kills noise. Demonstrations available. AERO DIGEST, Box 2538.

PILOTS EXAMINATION questions made easy. Send for new Quiz System giving questions and answers on aircraft, engines, navigation and Dept. of Commerce regulations. Prepare yourself to pass. Postpaid, only $2. Quiz System, 321 Griesheim Building, Bloomington, Illinois.

YOUNG MAN with $250 to buy half interest in plane and help transport pilot barnstorm, starting April. Will split 50-50 and teach you to fly. Only sober, ambitious man need apply. Bill Small, 1325 Second St. South, St. Petersburg, Florida.

UNUSUAL AVIATION opportunity for party with $10,000 to $25,000 bank credit or collateral (no cash needed) for use in establishing additional credit to take care of increased business. May consider young man with cash for key executive position. All replies confidential. References exchanged. AERO DIGEST. Box 2543.

THE BENNETT PLAN places new airplanes in operation for you. Ideal for flying clubs, or individual wishing to start flying business. Little or no capital necessary. Write Bennett Air Service, Box 247, Hightstown, New Jersey.

WE TEACH YOU TO FLY: Including Federal license, board, room and 25 hours solo flying, for only $195. New planes. Fleck Flying School, Springfield, Illinois.

FLYING JOBS WAITING for our graduates. Need more men. Commercial course only $290. Free booklet. We use new airplanes for training. Bennett Air Service, Hightstown, N. J.

## WANTED TO BUY OR TRADE

METAL TRANSPORT FUSELAGE, 12- to 20-place, wanted for children's playhouse. Write full description, dimensions and condition, also lowest cash price asked. AERO DIGEST, Box 2528.

FRANKLIN WANTED to license with Lambert. Also landing gear for Velie Monocoupe. P. O. Box 7, Hartsville, South Carolina.

WANTED: OX Bird right upper and lower wing panels. Prefer uncovered. Have J-5 engine or cash. Give full details, price, first letter. Box 265, Norton, Virginia.

WANTED: J-5 six-place Stinson, Fairchild FC2, also J-5, Lycoming, Continental A-40 engines and parts. State condition and lowest cash price. Andrew Bleau, Groton, Conn.

WILL TRADE income business property located in East Tennessee for Waco F, F-2 or C job. If warranted, will pay small cash difference. Write 90 Wilson Avenue, Johnson City, Tennessee.

WILL TRADE one late 1930 Stutz 8, 5-passenger sedan in extra good condition, only 15,000 miles, new tires, for good licensed OX job. R. A. McCurdy, 1895 Grand, Beaumont, Texas.

WANTED: Seaplane, amphibion or ship on floats. Must be at least 3-place or over. Full particulars first letter. R. Snover, 21 Monroe, Pontiac, Michigan.

WANTED: Have cash for best three-place ship offered. Desire Waco F, F-2, Fleet or similar ship. No junks considered. William B. Crow, 1321 Tenth Street, Douglas, Arizona.

WANTED FOR CASH: Velie M-5 or LeBlond 60. Give full details and lowest price in first letter. Max Gottfried, 1407 W. Nash Street, Milwaukee, Wisconsin.

WANTED: Irvin or Switlik silk training outfit. State condition, last time inspected and year manufactured. Terms desired. Robert Fronius, F-3/C, U.S.S. "Astoria", Long Beach, California. Division "A".

WANTED: Semi- or full airwheels and speed cowling for SM8A Stinson. For sale: OX-5 Scintilla magneto and gear box. Amsterdam Flying Service, Amsterdam, New York.

HAVE $900 CASH for J-5 Travel Air; if owner is Transport Pilot, offer him employment. Can use complete landing gear for Waco ASO; must be equipped with airwheels and brakes. North Central Airways, Inc., Homestead, Florida.

WANTED: Aeronca C-3. 1933 to 1936 model. Must be licensed. Bill Hinde, Huron, Ohio.

WANTED: Stinson for cash. '34 to '36. State condition, extras, time since major, etc. Give lowest cash price. Wire or phone "Al" Leeward, New Kensington, Pennsylvania.

APPROVED REPAIR DEPOT purchases for cash either damaged aircraft or aircraft requiring major overhaul. Write stating full details and lowest price. Address AERO DIGEST, Box 2545.

WANTED: Head temperature, outside temperature and manifold pressure instruments. Must be in excellent condition. J. R. Harrington, 375 Lexington Avenue, Mansfield, Ohio.

WANTED FOR CASH: Fleet Model 2, Kinner K-5. Good condition. Write details in first letter. Kenneth Sheetz, 1308 South Seventh St., Terre Haute, Ind.

WANTED: Have cash for 3-place open airplane. Prefer ship with J-5 motor. Any condition. Prefer Travel Air or Taperwing Waco. C. W. Siehl, Sherburn, Minnesota.

WANTED: Young man who desires to become a transport pilot and airplane mechanic, to invest $6,000 in a flying service in the West Indies. Must have some business ability and not be afraid of hard work. An excellent opportunity to learn the business from the ground floor. Will give an interest and pay a salary to the right man. AERO DIGEST, Box 2546.

WANTED: OX-5 American Eagle lower wings or will sell or trade for anything. Also want light plane, cash. G. Francis, 15750 W. Parkway, Detroit, Mich.

## HELP WANTED

WANTED: Airport operator. All-weather, lighted field. Modern hangar, 90 x 120. Dwelling. Apply William Mills, Chairman, Airport Commission, Muscatine, Iowa.

FLIGHT INSTRUCTOR: With A & E license preferred. Good appearance, personality and character essential. Position available immediately for right man. Somerset Hills Airport, Basking Ridge, N. J.

WIDE-AWAKE PILOT wanted, with or without 3-place plane, to instruct on "New Cub." Write Fleck Flying School, Springfield, Illinois.

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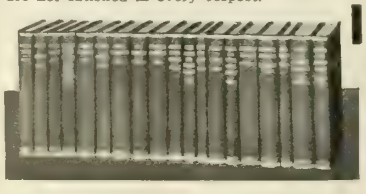
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I want to thank you for the excellent training I received while I was attending the Curtiss-Wright Technical Institute of Aeronautics.
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I must say your training gave me the start I required and I have never felt incompetent in any way after I had once found my feet in the British aircraft industry—thanks to your efforts with a fine course and efficient staff.
Yours very truly,
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(signed) MRS. ESTELLA KERNS.

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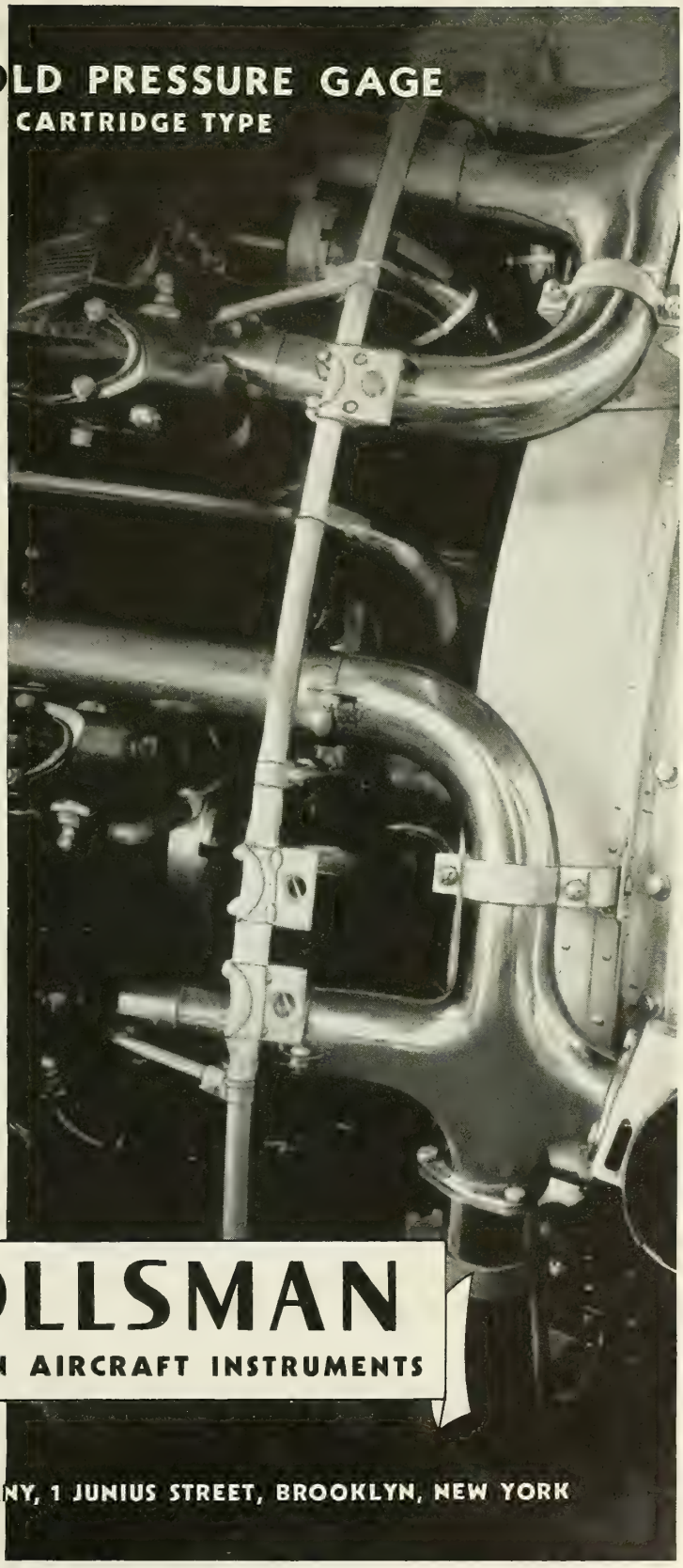
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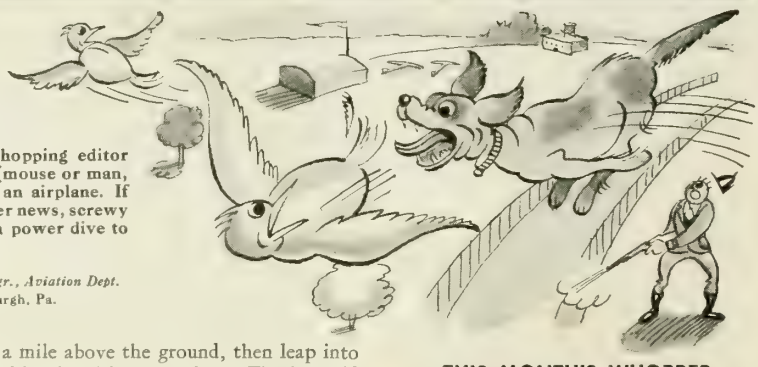
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**Among other cock-eyed items, your hedge-hopping editor would like to know whether any living thing (mouse or man, we don't care which) has ever been born in an airplane. If you have the straight dope on this—or any other news, screwy happenings or printable gossip—please take a power dive to the nearest swivel chair, and send a line to:**

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Gulf Aviation Products, Gulf Building, Pittsburgh, Pa.

## W. T. CALLED BAG OF WIND

"Either the editors in Bridgeport have been asleep since 1900 or W. T. is a bag of wind.

"I refer, of course, to the latter's spiel in the last 'Perch' about a night watchman flying a plane down the streets of Bridgeport several years before the Kitty Hawk flight.

"I've read Bridgeport papers for 40 years and W. T.'s story is sure news to me. I think it's a lot of hooey—and that W. T. ought to be fried in a big pan of his own banana oil." —A. S.




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"Garnerin's greatest rival was an Englishman, Blanchard. For a time the two were equally popular with the public. Then Mrs. Blanchard decided to join her husband in the risky business of ballooning . . . and the flying team soon made Garnerin take a back seat.

"But the Frenchman heard about the Russian girl. She was said to ascend half a mile above the ground, then leap into thin air with a parachute. The intrepid young lady actually made what is known today as a delayed jump, hurtling through space for hundreds of feet before she opened her parachute.



"Garnerin went to St. Petersburg. He saw her make one parachute leap and immediately signed her up as a teammate. Shortly thereafter, they were married.

"Returning to France, the Garnerins soon became as celebrated a team as the Blanchards. The rivalry between the families was tremendous. Each tried to outdare-devil the other.

"The rivalry almost cost Madame Garnerin her life. One day her balloon burst into flames and smacked her against a Paris housetop. Although injured, she did not lose her nerve, but started flying again as soon as she recovered.

"This correspondent cannot find what finally happened to the Garnerins, and would appreciate any further information." —C. F., Brooklyn, N. Y.

## WISH WE HAD A DOLLAR A HEAD

A few weeks ago American Airlines carried its 1,000,000th passenger—the world's first airline to reach this memorable figure. The editors extend their congratulations and sincere good wishes for the future.

## THIS MONTH'S WHOPPER

"There is nothing, gents, that I'd rather wrap my lips around than quail on toast.

"But I'm the worst shot in Newton County—and sometimes miss so many birds that even my dog won't speak to me.

"One day while hunting at the airport, my dog set three coveys, and after I had blazed away without bringing down anything but the corners of my lips, the dog got so mad that he just marched away and lay down beside a drum of Gulf Aviation Gas.

"The bung was loose and some of the gas had dribbled out. I saw the dog sniff, then bark like he'd found a bone, and begin lapping up the gas.

"I managed to get him away and on with the hunt. Soon he set again. On the rise I started to shoot, but what I saw froze me stiff. There was my dog speeding



through the air like a gol-darned hawk, gathering the quail on the fly. He got the whole covey before they'd gone a hundred yards.

"Now I don't take a gun with me any more, just an eye-dropper of your gas and the dog." —Dave Hovey, Union, Miss.


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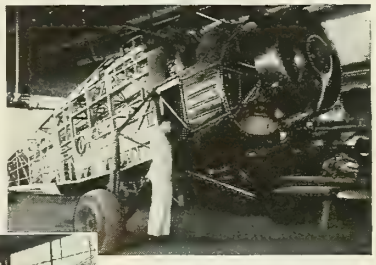
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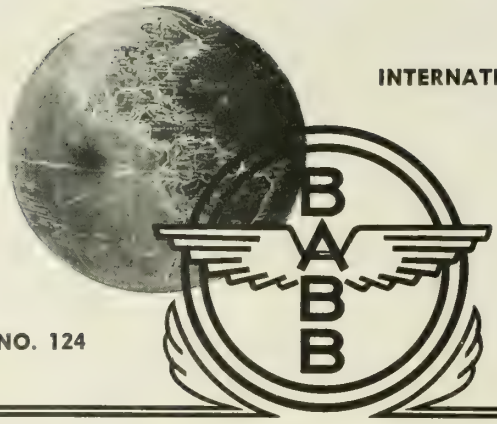
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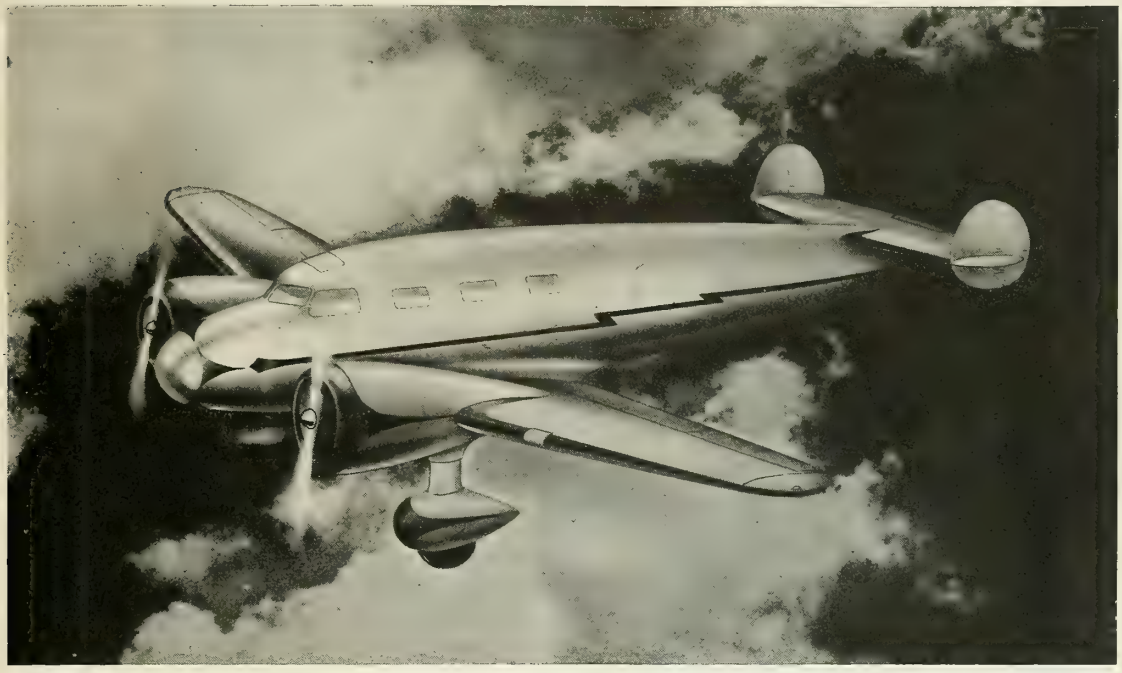
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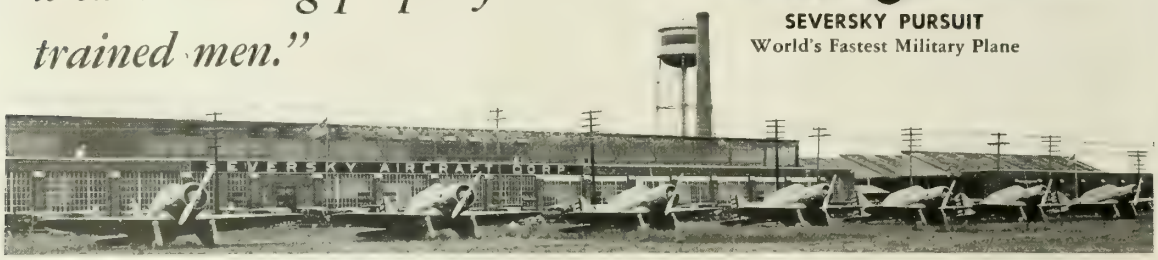
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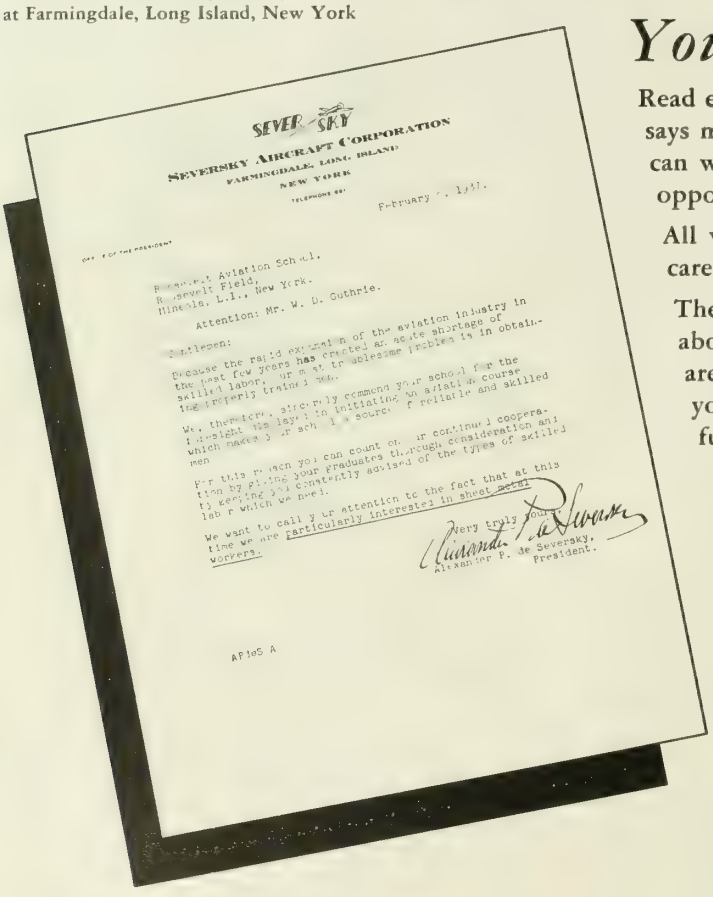
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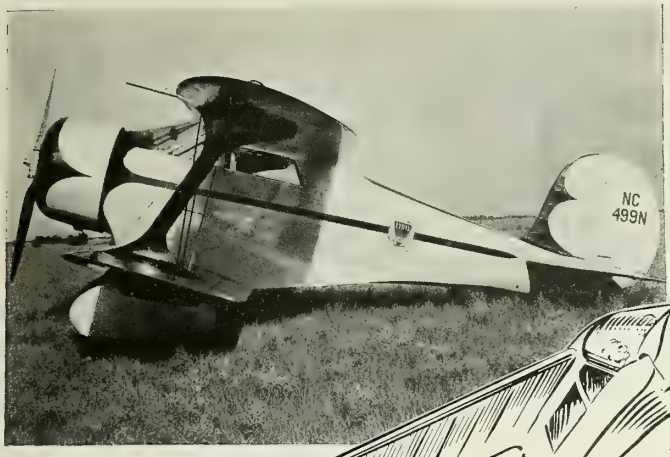
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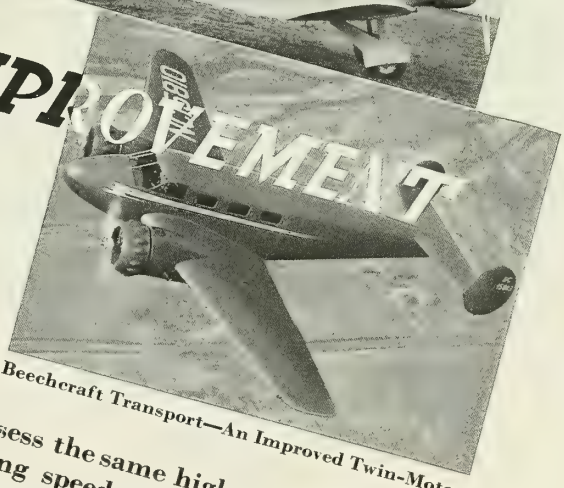
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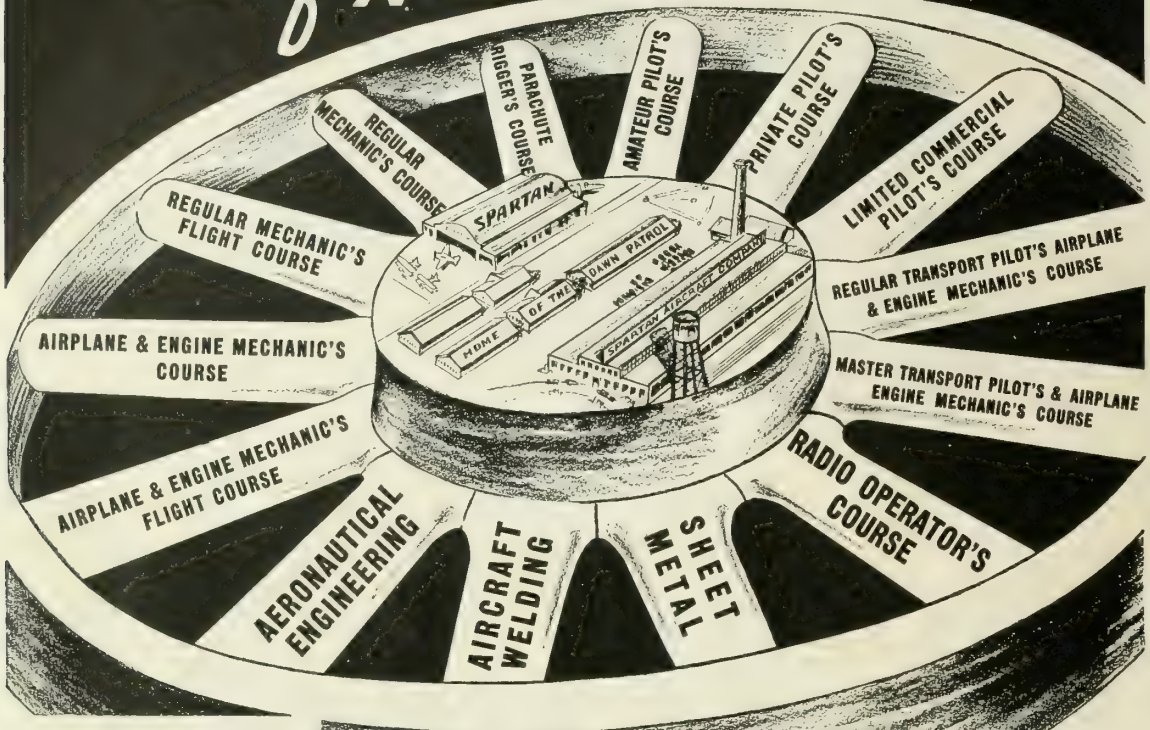
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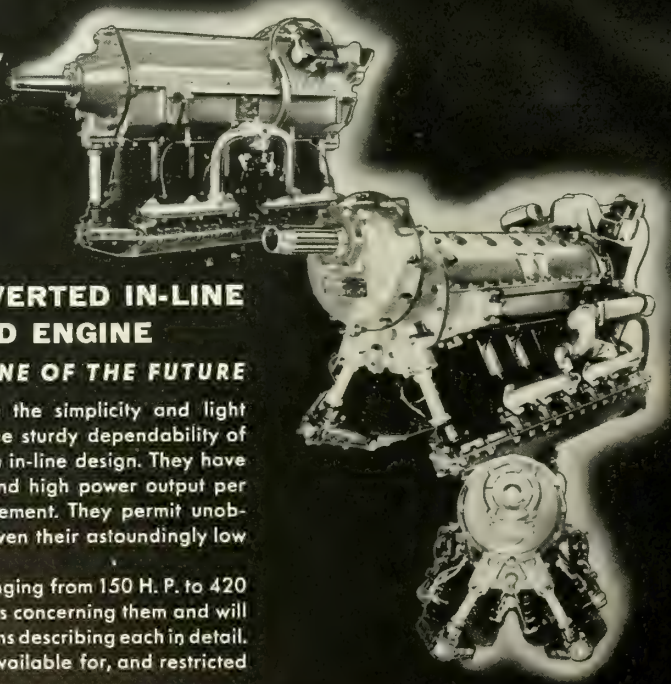
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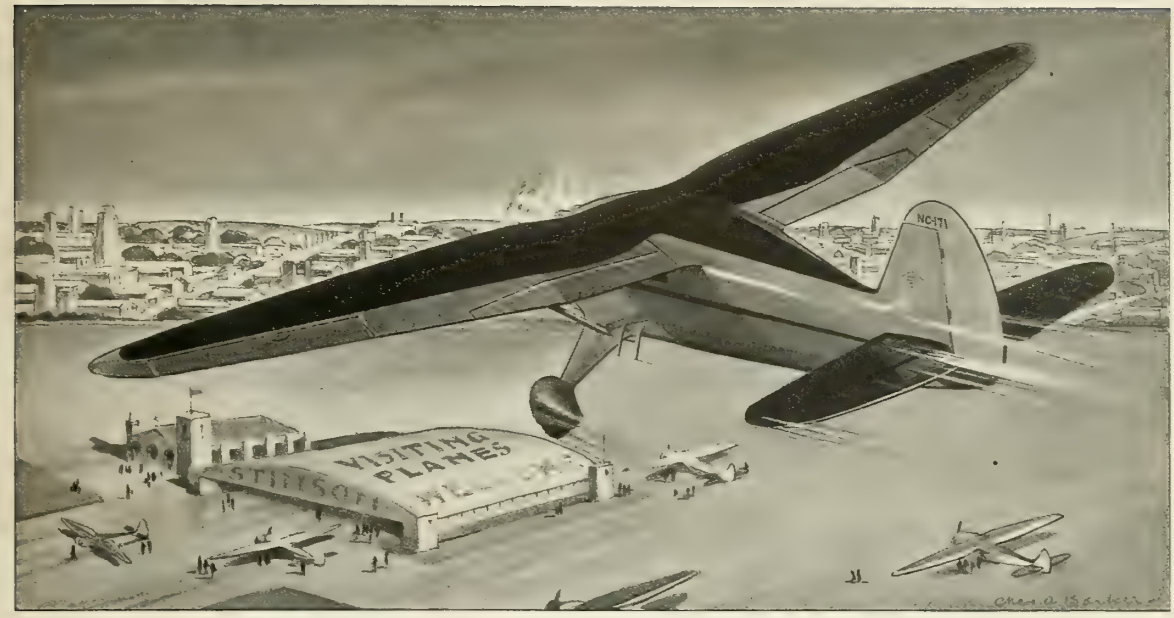
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TIME, *February* 8, 1937

# ARMY & NAVY

## *Routine Record*

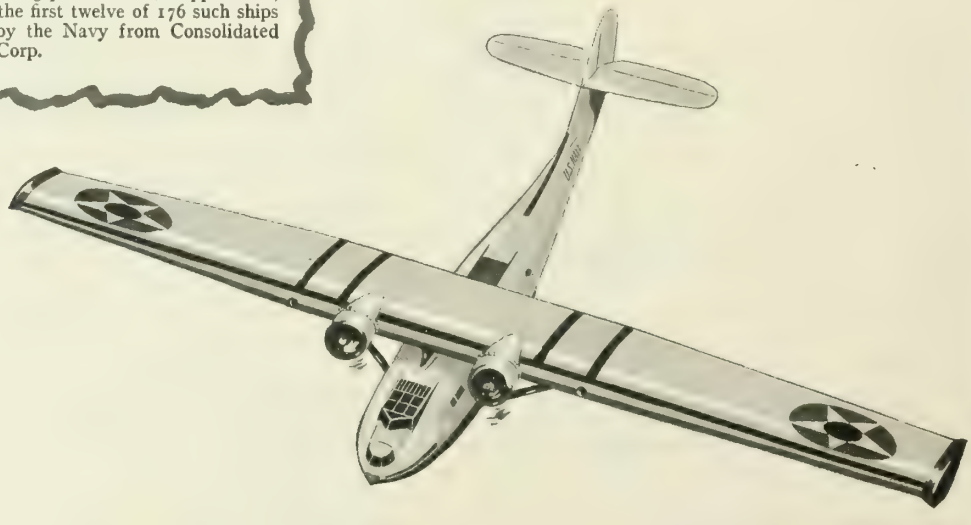
In January 1934, Navy flyers made the longest non-stop formation flight in aviation history. Patrol Squadron VP-10, consisting of six big Wright Cyclone-powered Consolidated Navy patrol flying boats and 30 officers and men, flew 2,399 mi. over the Pacific Ocean from San Francisco to Honolulu's Pearl Harbor in 24 hr. 45 min. (TIME, Jan. 22, 1934). The Navy's high command modestly waved aside the acclaim that followed this remarkable flight, said it was merely a routine transfer of men and equipment. Last week the Navy effected another "routine transfer of men and equipment," surpassed Squadron VP-10's mass-flight record.

One morning Lieut. Commander William McDade and 80 officers and men of Patrol Plane Squadron VP-6 climbed into twelve huge low-slung flying boats in San Diego Harbor, roared off without ceremony in trim formation toward Pearl Harbor, 2,553 mi. away. Next morning, 21 hr. 48 min. later, Patrol Squadron VP-6 completed its routine task without mishap at Pearl Harbor.

Patrol Squadron VP-6's new flying boats are called PBY-1 patrol bombers. With 1,100-h. p. Twin Row Wasp engines, retractable wing pontoons and clipper lines, they are the first twelve of 176 such ships ordered by the Navy from Consolidated Aircraft Corp.







CONSOLIDATED
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INCLUDING AVIATION ENGINEERING

VOLUME THIRTY NUMBER FOUR



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Two of twelve Pratt & Whitney Twin Wasp-powered Consolidated PBY Navy Patrol flying boats which recently flew nonstop from San Diego, California, to Pearl Harbor, Honolulu, 2553 miles in 21 hours 48 minutes. The flight was under the command of Lieut. Commander W. M. McDade, U.S.N.

# THE NEW DEAL IN WAR

CY CALDWELL

● War is a fight between human societies waged to gain an advantage or to defend some advantage previously gained. It is the natural and hence inevitable result of the growth of societies which can never be uniform because they differ with varying conditions of climate, land, race, religion and tradition. No power, whether of physical force or reason, can prevent this diversity nor repress the expansion of a vigorous community at the expense of a weaker one.

Thus the English, a vigorous people, spread from their small island to control an Empire; the Japanese, the "Englishmen of the Pacific," spread from their island to the mainland of China; the Italians expanded into Abyssinia; and the Germans, vigorous and intelligent, having torn up the restrictive Versailles treaty, are preparing again to seize their place as a dominant world power.

War is a part of the order or disorder of *nature*. Although its sufferings have turned men's minds to the hope of perpetual peace, there is no perpetual peace in nature; and man is a natural animal subject to nature's laws, as is demonstrated in biology, sociology, and the historical sciences. A world state would end international wars, but they would reappear as civil wars: the American War of Secession and the Spanish war are examples.

Nations are born in war, nourished in peace; they maintain their status as independent nations *only* by their ability to wage war and resist aggression. The United States became a nation not by peaceful means, but by its power to fight England and win its independence. It must cease to be a nation when it loses the power to defend itself under the changing conditions of war. China offers a modern example of lost national defensive power; Japan and Italy present instances of aggressive national policies carried to successful conclusion. War takes no interest in "right" or "wrong"; what is believed to benefit the nation and foster its growth is held to be right—all else is wrong. Hence the winner is always right, the loser always wrong.

As in nature, so it is with men and nations; the strong survive, the weak perish. Diplomacy, leading to political alliances, may prolong for a time the national life of weak states, but the fate of nations that cease to defend themselves is never in doubt.

As wars are inevitable, it would be well for us as American nationals, hated by many nations, to inquire what influence upon war's conduct may be exerted by the new weapon of air power, *the new deal in war*.

Those charged with our national defense are but dimly aware of what air power actually means. Our air policy is not under the control of airmen; it is under the control of *ground* Army officers on the General Staff who have been trained to believe that "the Infantry is the Queen of Battles." The fact that the two temporary-rank Major Generals now commanding the Army Air Corps and the G. H. Q. Air Force are air officers does not alter the fact that actual control is vested in the Chief of Staff, a *ground* officer, and that *every* general on the General Staff is the superior in line-rank to these temporary air generals. No foreign European air force faces this major handicap of ground army control.

Military men are noted for their aversion to change. Yet this ever-changing new deal of air power is upon them. It will change everything in war except army and navy officers. They study the battles of Nelson, Togo, Hannibal and Napoleon, learning how men moved upon the sea and the land in centuries past; they do not visualize how men may move in the air during the next war. Lulled to a sense of security by those oceans whose waves lap our shores, our surface-crawling defenders slumber on. Our ground-army General Staff, charged also with the *air* defense of our country (only God and the politicians know why) is prepared to fight the war of 1914-1918, just as in 1917 it was only ready to fight the Spanish-American War of 1898. The General Staff always is ready for the war just past; it never yet has been ready for the next one.

As the next major war probably will be between the Fascist nations of Europe and the still Liberal nations (with Russia probably pretending Liberal leanings for the duration of that war), we may profitably think about it and the advances that it will effect in the use of air power.

The dominant factor in land battle is the controlling mind and will of the commander, whose objective is to outwit his antagonist and to demoralize the opposing army, usually by killing and wounding, to produce in it disorder and confusion, to transform it from an organized body into a disorderly mob. An Army commander therefore tries to detect in the enemy's order some point where an effective blow will dislocate its system or structure. In the days of Napoleon or Lee, whose battles are models for our General Staff, the weak points of an army were its flanks and rear; today, however, the flanks have vanished in the continuous front extending for hundreds of miles along a nation's borders. This renders a major war of movement as dead as Napoleon. Generals hope that mechanized armies will be able to maneuver; but they can do so only until their opponents dig in—digging also elephant-pits for catching attacking tanks and armored cars. The tactics of Frank Buck, who brought 'em back alive, are sufficient to stop any "war of maneuver" a General ever conceived. Tanks don't get out of pits. *Mass armies* preclude movement on the ground; the ground army cannot get itself moving again with mechanical ground equipment. Thus land battles are reduced to push and be be pushed, or brute strength stuck in the mud until starvation, war-weariness,



*Our air policy is dictated by ground Army officers on the General Staff*

*or other means* forces one side to sue for peace. Mass armies now expose no points that they cannot strengthen quickly from the rear; they may be dislodged only by direct frontal attack, which is more costly to the attacker than to the defender.

*The nation behind the army,* however, *has thousands of weak points* in its hundreds of cities and towns, its ports, railroads, power supply stations, its industries and business, homes, shops, municipal water supplies, its transportational facilities (including shipping in port) its food and other supplies in storage and in transit by land and sea.

An army can oppose a strong front to an enemy; but a nation lies exposed *in all its weakest points* to an enemy using air power. As the commander of an army seeks the weak points of an opposing army, so must the higher political commanders of a nation discover weak points in the enemy nation—and instruct their air commander to hit these from the air. In that way the enemy's army also can be defeated; for armed forces in the field cannot function unless they are assured of continuing supplies of food, ammunition and other essentials from the unarmed fighters on the home front. It must be recognized that working civilians are a vital part of the fighting power of a nation, for *the entire nation is at war,* not merely the uniformed forces.

#### The Winged Messenger

This is the new deal in war: the airplane is its winged messenger. The vital message it drops in our laps is that we must evolve a new form of strategy in this dawning air age—the higher all-commanding strategy of the air.

Strategy is the science or art of projecting and directing important military maneuvers or operations, and of the combination and employment of means on a broad scale *for gaining advantage in war.* It doesn't matter how you gain the advantage, or what anyone thinks of the means, *so long as you win.* If you lose, of course, you are wrong. Other forces being equal, the commander who uses his intelligence and imagination to the best purpose must win. Even with smaller forces the superior strategist should win, as Napoleon frequently demonstrated by defeating forces three times as strong as his own. Napoleon had imagination; Foch, Haig, Hindenburg, and Pershing had only armies—and General Staffs. In four years 7,000,000 men died under the personal direction of the world's unimaginative General Staffs.

If the impending European war is fought along traditional sea and ground lines, with the air playing only the auxiliary part that it performed in the last great war, it is certain that all parties to the struggle must end it exhausted and bankrupt. This is a consummation to be avoided; therefore, the intelligent stategist will seek some way to win a speedy decision, to *gain the advantage* before his country approaches exhaustion; before he is faced with internal revolution in his own civilian, military, and naval elements—for revolution now marches hand in hand with war, as Russia and Germany learned 20 years ago.

Knowing that ground forces can only hold on and batter each other for years, the thinking strategist will assign to his army the task of occupying and holding what territory it can. As the combined Facist navies are weaker than the combined Liberal navies, they will be ordered to remain in port awaiting a chance movement for attack, meanwhile sending out only surface, air, and under-sea commerce raiders. Thus the land and sea forces are considered primarily defensive forces, as they necessarily must be on the weaker side.

Speed of victory, however, is essential to the Facist powers, for their political and economic foundation is weaker than that of their enemies. They can be shut off from world commerce by superior navies, and thus in time be starved. *Time,* therefore, is the determinative strategical element; not only must the high commander ask himself if such and such a plan will work, but will it work in time? Germany and Italy probably understand that in a war against England, France, and probably Russia they must win quickly or lose slowly: France and England are prepared; Russia today is not the unarmed mob of 1915.

What *one* fighting element may bring speedy victory? *It is air power.* A ground and sea war *must* be lengthy; an air war *may* be short. All war is a gamble; but the air war looks like a good gamble, especially to the weaker adversary. Before land forces can be set in motion, before the first troops have crossed the frontier, before the first naval squadron has cleared harbor, the air forces can be speeding on their appointed missions.

Every battle was *imagined* before it was fought—it was planned down to the last detail by the commander and his staff. The effective commander is the imaginative one; the ineffective commander ties himself to the military text books—his enemy has read those books, too, and knows all the answers. Success in war depends to a great extent upon surprise, at least in a war of movement—and the air is the only sphere where armed forces may move freely.

If we have correctly appraised the basic national conditions of the impending Fascist-Liberal war, we are equipped with a large part of the data which the chief Fascist strategist also is considering; hence we may attempt to follow his reasoning. He knows he must gain the advantage quickly and must not waste his lesser resources. Speed dictates the use of air power. But in air power he is much weaker than his opponents. The present Spanish war has demonstrated that Russian pilots are the best trained, the most efficient fighters, with the best ships; that the Italians are excellent pilots and have good equipment; that the almost new German air force is composed of green military pilots, most of them young and inexperienced, and that the German equipment, all of recent development, is unsatisfactory. The German force is as yet third rate by any standard except that of numerical strength. The French Air Force is first class, and the English Royal Air Force is the most efficient and experienced air force in the world.

It is necessary to conserve and use to best advantage this smaller and less efficient combined Fascist air force. That dictates the strategist's planned use of it; therefore the policy that he must follow is forced upon him by conditions over which he has no control. If he were stronger in the air, he might plan differently—and possibly less effectively. As it is, his desperate need to make the most effective use of weaker and not so well-trained air forces dictates night rather than day operations, and the selection of area objectives rather than precision targets. That is to say, instead of risking his forces day after day or night after night to destroy purely "military" targets (under the old-fashioned ground army definition)—such as bridges, railroad yards, factories, ammunition dumps, and power houses—he must send his force over only at night to hit *entire cities* and destroy them in whole or in part. If this procedure does not bring him the advantage *in time,* his stronger enemy eventually must overwhelm and destroy him.

#### Destruction of London

London obviously is the first city he will select to destroy. But how is a great city like that to be destroyed by only one air attack? Those who have studied the lessons of bombardment with explosive bombs in the World War and in the recent bombing of Madrid probably will agree that such bombardment is costly and somewhat inefficient—though very effective within definite limits when administered by highly trained forces. But the Fascist force, with the exception of the Italians, is not highly trained—in fact, the German air force is but little more than an enthusiastic inexperienced air mob. Such an uncertain, untried force must be given an easy task to perform, or it will fail. Thus expediency again dictates the means that must be employed—fire.

Let us consider fire as we encounter

(*Continued on page* 97)






# Food Service on Air Lines

**DONALD MAGARRELL**

Head, Food Service Dept., United Air Lines

● A few years ago an aerial meal service consisted of sandwiches and coffee in paper cups, with apples, oranges and candy bars for dessert. Today a choice of entrees and full course dinners are served. United Air Lines for instance has perfected its aerial meal service so a stewardess can serve 21 people within one hour and ten minutes, or three minutes per passenger. The luncheon is assembled on the ground, packed in special containers. The stewardess devotes only a minute to making up the passenger's combination tray, with a domed cover, in which is packed a complete meal with the exception of liquids, which are added by the stewardess.

On the non-stop Chicago-New York and the three-stop coast-to-coast flights, foods are packed in individual portions. Fresh vegetables are carried in jumbo thermos jugs, out of which the stewardess turns the vegetables onto the dinner plates. Salads are placed in a paper cup with a cover, and these salads are unique in that they are packed upside-down.

Specially designed dinner plates, cups and saucers of porcelain, and even special silverware, are provided. Each passenger has an individual table, or swivel chairs can be turned around so that two or four people may dine together.

Perfections in United's meal service include use of dry ice as a refrigerant. Ice cream, butter, cream, milk and salads are chilled in this manner. Milk is packed in a newly-designed cardboard container. Dinner plates are warmed by an element which generates heat by addition of two tablespoons of water.

United now has three classifications of meals, "A," "B" and "C." The "A" meal is a complete dinner served at noon and at the evening dinner hour. The "B" lunch, a mid-afternoon snack, consists of sandwiches, fruits, cheese and crackers, petit fours and cakes. When served before bedtime, "B" lunch consists of fresh fruit, fruit juices, sandwiches and cookies. For breakfast on the "C" type meal the air traveler has a choice of five kinds of breakfast food, fresh or stewed fruits, and scrambled eggs and ham or bacon. On all trips passengers have a choice of coffee, tea, hot chocolate and fruit juices. In summer, cold lemonade and carbonated beverages are available. Passengers flying at night may obtain caffeinless coffee.

A typical "A" lunch on United Air Lines includes fresh fruit or shrimp cocktail, celery hearts and mixed olives, a choice of fried chicken or lamb chops, potato, fresh vegetables, salad and dessert.

Only foods which are generally popular and enjoyed by the majority of passengers are selected for the menu.

Service for New York-California-Pacific Coast planes requires food depots at Newark, Cleveland, Chicago, Omaha, Cheyenne and Salt Lake City, with commissaries also at Los Angeles, San Francisco, Portland and Seattle.

At intermediate stations, such as Cleveland, the caterer has a short wave radio set to receive pilots' messages on exact arrival times and number of lunches required.

Quantities of specially designed paper and parchment containers and wrappers are used to facilitate the meal service and to insure cleanliness. For United's new Skylounges operating between New York and Chicago, a total of 328 pieces of equipment, such as cups, plates, napkins, and containers are used to serve fourteen meals—illustrating the complicated routine practised to provide meals comparing favorably with those served in hotels.

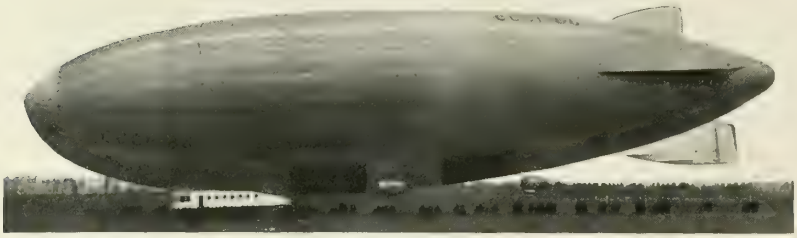


*A United Air Lines' Mainliner*

# SOVIET AVIATION TODAY (Part II)

PEYTON M. MAGRUDER and LUCIEN ZACHAROFF

**Part II presents a digest of civil and militairy aircraft types and engines, discusses the work of the "Osoaviakhim," the administration of the Civil and Military Air Fleets, dirigible construction and other aspects of USSR aviation on the eve of its twentieth birthday. All accompanying photographs courtesy of "Sovfoto"**



*The new Soviet V-6 dirigible about to make its initial flight*

● The *Osoaviakhim* is charged with stimulating national airmindedness in the USSR; it unifies similar organizations in regional republics, these being broken up into districts, counties and cells, the latter being the primary unit found in factories, schools, clubs, on collective farms, etc.

In addition to aviation, the 7,000,000 *Osoaviakhim* members take profound interest in the problems of anti-aircraft and anti-chemical defense.

Gliding circles, parachute stations, workshops, airship navigation studies, central and local clubs are sponsored by *Osoaviakhim* which also organizes educational tours, flights around the USSR and abroad, and contests. Its constituent groups own airplanes, balloons, gliders, parachute towers and other equipment.

The Chief Inspection of the Civil Air Fleet of the USSR, headed by Corps Commander I. F. Tkacheff in Moscow, directs all activities, planning and regulation of construction in commercial aviation. The latter handles air transport and all its phases.

Under the jurisdiction of the scientific-technical department of the Supreme Economic Council, one of the two sections of *Osoaviakhim,* are the Central Aero-Hydrodynamic Institute which concerns itself with aircraft building and the Scientific Motor Institute which deals with aviation engine construction. Both headquarter in Moscow.

Directed by N. M. Kharlamoff, with Prof. A. N. Tupoleff as chief engineer, the Central Aero-Hydrodynamic Institute is engaged in theoretical and experimental work, relegating production of the types it develops to Plant No. 22 at Fily. Its ever-expanding laboratories and shops test materials, make chemical analyses, engage in mechanical testing, and wood, metal and Roentgen-ray research. Its hydrodynamic section has an elaborate testing tank, while the economics of aeronautics are studied by another group of specialists.

The Institute is responsible for the numerous high performance ANT types, one of which, the ANT-4 in 1929 flew from Moscow to New York. Incidentally, this type is now being produced in the military factories as a twin-engined bomber reconnaissance land or seaplane known as the R.6 or TB-1. Other types include the ANT-3, a sesquiplane, which in military service is called the R-3, and the ANT-6, a four-engined bomber.

### Airlines' Organization

At present, organization of airlines and routes by the Civil Air Fleet broadly conforms to the following plan. Because of the extent of Soviet territory, the country is divided into Regional Managements of Civil Aviation. These are Moscow, Ukraine, Azov-Black Sea, Transcaucasian, Caucasian, Central Asiatic, Ural, Volga, Western Siberian, Eastern Siberian, Far Eastern, Northern. Involving thousands of miles these Regional Managements operate airline terminals and the many ramifications of air travel such as information bureaus, restaurants and ticket agencies.

Generally speaking, the principal Soviet routes operate along about 53,000 miles of airlines, all of which radiate from Moscow. The longest, Moscow-Vladivostok, extends for 6200 miles, and has a branch from Irkutsk to Yakutsk, one of the outlying metropolitan centers. Moscow and Tashkent are brought together by two lines. One, touching Akhtiubinsk, branches from that point to Uralsk-Guriev-Kustani; the other, via Sverdlovsk, branches to Magnitogorsk and Alma Ata. Another line links Moscow



*The P-5 redesigned to carry 14 soldiers in compartments below the underside of the wing*



*Nose section of the eight-engined "Maxim Gorky"*

with the cities of Stalingrad and Elista.

Moscow's connections with the south are via an air route to Kharkov and from there to Kiev and Odessa, and on to Rostov, Tiflis, Erivan and Baku. The shortest trunk line—Moscow-Leningrad—has branches to Petrozavodsk and Vitegra.

Customs airdromes in Europe include those at Moscow, Leningrad, and Velikye Luki, and in Asia at Baku, Irkutsk, Verkhneudinsk, Khabarovsk, Tashkent and Termez. Other important civil airports are at Alma Ata, Alexandrovsk, Astrakhan, Baysun, Barnaul, Dnepropetrovsk, Chukhotsky, Grandzha, Guzar, Kazan, Kharkov, Gorki, Omsk, Orel, Penza, Riazan, Samara, Semipalatinsk, Sergiopol, Stalinabad, Sverdlovsk, Tiflis and Turkestan. Some essentially military fields are also utilized by the Civil Air Fleet. Since Part I of this article appeared in the February 1937 issue of AERO DIGEST, a great many of the routes described have been equipped with beacons for night flying, the absence of which was one of the principal shortcomings of Soviet transport aviation.

**Military Aviation**

Military aviation is divided into 15 districts, each operating under its Military District Commander who has as his adviser the Chief of Air Forces of the district. Army Commander Y. I. Alksyns heads the country's air forces which he will command in the event of war, and he is responsible for the administration, training, supply, etc., of the air fleet.

Besides the air forces in the military districts there is also the Independent Air Bombing Force which, for operational uses, is directly under the General Staff of the Workers and Peasants Red Army. Both the Military District and Independent air forces are divided into air brigades, each comprising from two to six squadrons. The smallest tactical unit is the "link," three of which constitute a flight. Three of the latter make up a squadron.

Estimates of first-line strength are conjectural, but conservative sources appraise the USSR air force at about 3500 aircraft, although the estimate of 7000 military aircraft is frequently favored. Including units attached to the Red Navy, the total number of air brigades is about 40. Types of aircraft in the Soviet air forces range (by percentages) as follows: fighters, 35%; reconnaissance and light bombers, 33%; heavy and medium bombers, 22% and attack craft, 10%.

Heavy and medium bomber squadrons have 12 initial aircraft, while all other classifications listed in the preceding paragraph have 31 each.

Resembling Germany's single-seat Heinkel fighter, the I-7 is a biplane with a water-cooled 600 hp engine and attains a maximum speed of about 200 mph. Another biplane is the I-15, armed with 4 machine guns and powered by a Wright Cyclone engine which gives it a maximum speed of about 230 mph. Also equipped with 4 machine guns, the low-wing I-16 attains 240 mph.

The armed service units are soon to be provided with a new type to replace the general purpose R-5. It is a biplane with a 600 hp M-17 engine and has a maximum speed of 150 mph.

TB-3 stands out among heavy bombers. This four-engined monoplane, which has 750 hp M-34 RN engines has been manufactured in quantity for about four years. It is armed with 6 machine guns and has a maximum speed of 125 mph, a range of 450 miles with a 3000-lb. bomb load and 900 miles with a 1000-lb. load.

Representative medium bombers include the TB-1 and SB, the former having two M-17 engines of 600 hp each which give it a maximum speed of 130 mph, and an operating range of 650 miles with 1000 lbs. of bombs. With two Wright Cyclones, the SB, a mid-wing monoplane, carries 1000 lbs. of bombs for 650 miles at a top speed of 210 mph at 10,000 ft.

Included in the flying boats are the twin-hull Savoia S-55 and the single engined Savoia S-62, as well as Dornier Wal and MDR types. The prevailing type of training aircraft in the country's 11 military flying schools in 1936 was the U type which resembles the Avro Trainer. The Air Forces Academy in Moscow combines the work of a staff college, engineering college and senior officers' school.

Manufacture of military aviation equipment is in charge of the War Aircraft Trust within the Commissariat of Defense. This unit operates aircraft and



*Soviet bombers of the Military Air Fleet engaging in maneuvers over the vast far east territory*



*Some typical types of more recent Soviet craft. From top to bottom the planes shown are: the 4-place Khai-1; the plane in which Levanofsky attempted a Moscow-San Francisco flight; the ASK amphibion; and the "Amphibia" Sch-1*







engine factories, accessory enterprises, repair shops and experimental plants. It has control over a number of forest lands which supply it with ample quantities of wood for airplanes and propellers.

For years the Soviet Union has been producing chrome molybdenum steel tubing at the Krematersky factory and stainless steel at the Yshchevoker factory. Light alloys for aircraft production are made at the Kolchugina factory which turns out sheet, strip and rivets; the Voroshiloff factory in Leningrad which produces tubing and fairings; and the new rolling mill near Moscow which takes care of sheet, strip, fairing and wire requirements.

Leningrad's Rubber Trust furnishes tires and rubber cord while Moscow's recently-built plant turns out magnetos, spark plugs, lighting and electrical apparatus. The Fine Mechanics Trust produces navigation equipment and the Electro Trust provides radio apparatus.

Until recently engines of foreign design predominated in the USSR's aviation engine factories, particularly the Wright Cyclone M-25; Bristol Jupiter M-15; Hispano-Suiza Y series and Gnôme-Rhône K-14, all of which were built under license. Among engines of domestic origin may be mentioned the 100 hp 5-cylinder radial M-11 for training planes, and the 950 hp 12-cylinder Vee water-cooled M-34 employed in the heavier single- and multi-engined craft in the army. The leading aviation engine factories are No. 24 in Moscow; No. 26, Rybinsk; No. 29, Zaporozhie, and Plant M, Perm.

Repair shops for planes and engines are in Leningrad, Kiev, Smolensk, Sevastopol and elsewhere. The War Aircraft Trust obtains skiis and wood propellers from Plant No. 28; paints and varnishes for the entire industry from No. 30; standardized bolts, screws, nuts and parts from No. 33; and carburetors, fuel pumps, gears, and armament from No. 20. All of these plants are in Moscow.

The comparative quiet in dirigible construction in the USSR may be misleading. Such indices as the engagement of General Umberto Nobile as adviser on and designer of lighter-than-air craft, and considerable theoretical discussion in the press, point to businesslike activity. In connection with General Nobile's engagement (recently terminated), a plan formulated a few years ago called for the construction of seven airships—the *Lenin, Klim Voroshiloff, Pravda, Kolkhoznik, Stary Bolshevik, Komsomoletz and Profintern.*

*Klim Voroshiloff* was the first to be completed. It is of the semi-rigid type and measures 341 ft. long, 82 ft. in diameter, and has a capacity of 776,820 cu. ft. Its estimated speed is 62 mph. It is designed to carry 16 persons and 220 lbs. of baggage, in addition to crew.

Another airship is to be 492 ft. long, with a capacity of 1,942,050 cu. ft. Four smaller non-rigid airships, each of 10,000 cubic meters capacity, have already been tested. Recent progress was reported to be so gratifying that within a year regular airship lines may be launched.

In the commercial field, the ANT-9 is a popular tri-motored type. It is a high-wing all-metal cantilever monoplane powered by 230 hp Gnôme-Rhône *Titans.* Outboard engines are mounted in front of the leading edge of the wing at the extremities of the center-section, their nacelles streamlined into the wing. The center-section houses the fuel tanks.

Performance figures show a maximum speed of 130 mph; cruising speed 106 mph; climb to 6560 ft. in 15.5 min., and to 10,000 ft. in 30.5 min. It has a ceiling of 12,500 ft. and range of about 560 miles.

The five-engined 36-passenger ANT-14 is a high wing cantilever monoplane with a three-section bi-convex wing. With a maximum speed of 130-136 mph at sea level and landing speed of 46.6 mph, the plane has a service ceiling of 13,120 ft. Four of the Jupiter 9AKK air-cooled radial engines of 480 hp each are mounted in the leading edge of each wing and one is in the nose of the fuselage. Four fuel tanks are in the wing.

Largest land plane in the world, the ANT-20 (*Maxim Gorky*) was successfully flown for many hours, until it was in a collision with a stunting plane in May, 1935. The accident was no reflection on the safety of ANT-20 and almost immediately the Government promised the construction of 16 more machines of this type, to be fitted, however, with six 1200 hp engines instead of eight 750 hp engines as in the *Maxim Gorky*, the tandem pair over the fuselage being eliminated. The wing of the ANT-20 can be dismantled into several sections. Five sections of the fuselage are joined by steel fittings. The divided-type undercarriage's two forks each carry twin wheels, hinged by V-shaped bracing to the fuselage.

Sixty passengers and a crew of 8 are accommodated in compartments in forward and aft sections of the fuselage and

the wing's center-section. The crew consists of commander, two pilots, engineer, radio operator, two mechanics and a steward. There are four compartments seating four passengers each in the center-section.

Span of the ANT-20 is 206 ft. 7 in.; length 108 ft. 3 in.; height 29 ft. 6 in.; wing area 5228.36 sq. ft.

Another type being built in quantities for transport use is Stal-11 built by the Scientific Research Institute of the Civil Air Fleet, which had previously constructed the Stal-2 and Stal-3, both of which are of welded stainless steel-tube and sheet, with Engineer A. I. Putiloff, chief designer, in charge.

Stal-11 is a low-wing monoplane with retractable undercarriage and is powered by a liquid-cooled M-100 engine developing 860 hp at 4500 ft. In regular service Stal-11 is expected to have a maximum speed in excess of 267 mph, and a cruising speed of about 230 mph. According to Designer Putiloff, the ship is intended as a mail transport on long hauls, and for passengers on shorter runs.

Although the basic type of training plane in the USSR has been the U-2, it is being replaced by the AIR-8 and AIR-9, designed by Engineer A. S. Yakovleff. Also in the AIR series is the AIR-5, a high-wing braced four-place cabin monoplane. The welded steel fuselage is braced with piano-wire; the forward section, forming the cabin, is covered with duralumin sheet, and the rear section with fabric. It has a maximum speed of 118 mph; cruising speed of 94.4 mph; landing speed 46.5 mph; ceiling 14,760 ft.; and climbs to 3280 ft. in 6.5 min.

AIR-6 is a smaller counterpart of AIR-5. Powered with a 100 hp 5-cylinder M-11 engine is accommodates either two or three persons. Maximum speed is 105.5 mph; cruising speed, 96 mph; landing speed 37 mph.

A Soviet-built M-22 9-cylinder radial engine and a Soviet adjustable-pitch propeller feature the two-seat high-performance AIR-7, a low-wing braced monoplane with a welded steel tube fuselage covered forward with duralumin and aft with fabric.

In 1936, the experimental light aircraft plant GUAP produced the AIR-10 and AIR-14. The AIR-10 is a two-place training monoplane with a maximum speed of 135 mph and the AIR-14 is a single-seater with a maximum speed of 156 mph. Both are adaptable for advanced work.

GUAP has also produced AIR-11, a mail-passenger transport designed for serving large industrial enterprises and executive committees. A low-wing monoplane, it is equipped with a 120 hp engine, its cabin housing the pilot and two passengers. Its maximum speed is 143 mph; cruising speed 130 mph; landing speed with slots 40 mph; range 550 miles; and ceiling 19,685 ft.

Engineer Kalinin at the Kharkov plant bearing his name is responsible for the design of one of the most widely used commercial planes, K-5, a single-engined 10-place monoplane powered by a 450 hp M-15 engine. K-5's maximum speed is 123 mph; landing speed 56 mph. Dual controls are provided and aft of the pilot's seats is a cabin for eight arranged in two rows of four seats each with an aisle between. Lavatory and baggage compartments are aft of this section. Useful load is 3300 lbs.; gross weight 7700 lbs.; span 67 ft. 2.5 in.; length 51 ft. 6 in.; wing area 605.25 sq. ft. Another high-wing single-engined plane is K-6 designed for mail transportation. A 420 hp Gnôme-Rhône Jupiter engine on a welded steel mounting is joined to the fuselage bolts.

Among the popular designs of V. K. Gribovsky is the recently completed all-wood G.22, a low-wing light sporting and training monoplane. It is provided with a 40-60 hp engine and has fixed slots along the leading edge.

Believing that in many portions of the USSR the light amphibion will receive wide application, Engineer V. B. Shavroff recently completed the Sh-3. Entrance is at the trailing edge of the wing, and the cabin accommodates a pilot and two passengers. Powered by a 125 hp Cirrus-Hermes engine, the Sh-3 does 122 mph maximum; 103 mph cruising; 31 mph for landing. It has a range of 625 miles.

The Bykovsky Shops of the Civil Air Fleet early this year started production of the PR-5, which operates on the Tashkent-Kabul Air Line. The four-place cabin is heated and ventilated and the plane is fully equipped with radio.

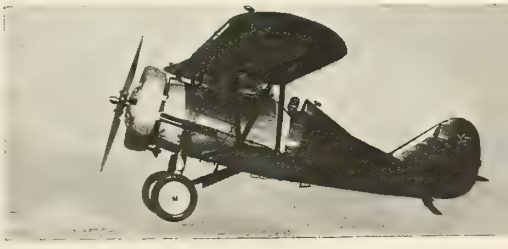
The types of aircraft described in this series and others now being designed or under construction in the Soviet Union will be mobilized this year to fulfill the annual task of transporting 180,000 passengers, 38,000 tons of express and 6200 tons of mail, not to mention the continuation of the special applications in industry and agriculture which in 1937 is expected to total 175,000 flying hours.











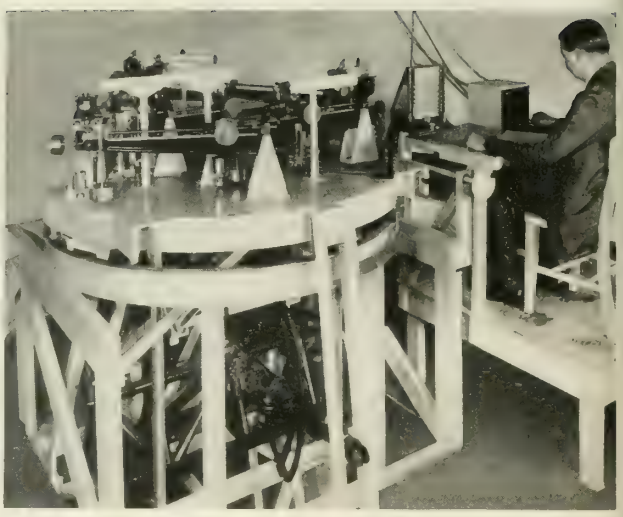
*Other representative types of Soviet aircraft shown here are, from top to bottom: the 10-place twin-engined ANT-35 transport; the Avianito-1 for sport flying; a training plane being flown by girl students; and a light airplane of the biplane type*

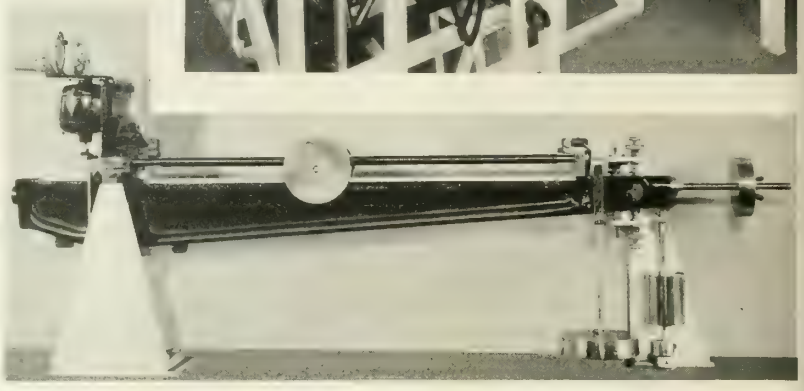
# Test Methods Involved in the Operation of a Commercial Wind Tunnel

BRUCE G. EATON, JR.

Curtiss Aeroplane Div., Curtiss-Wright Corp.

**More than a decade has passed since the first of three wind tunnels started operating in connection with the Engineering Dept. at the Buffalo plant of the Curtiss Aeroplane Div. of the Curtiss-Wright Corp. A description of the tunnel now operating (completed in 1931) is presented here, together with a discussion of the new balances and test methods.**





*Above: Operating table with manometer on left. Below: Automatic beam-type balances*

● Two problems confronting wind tunnel operations in a private concern are in slight variance with Government and institute owned tunnels. Primarily, an airplane model must be tested completely in the shortest time to avoid delay in furnishing design information to the Engineering Dept. As most projects require close schedules and many man-hours of engineering work, *ab initio,* any delay in the wind tunnel program may prove to be costly. Secondly, a research program may be necessary at any time during a model test to eliminate any undesirable characteristics that appear as the model test progresses. To meet these problems with accurate tests in as short a time as possible it is necessary to have a flexible tunnel set-up and staff with a closely-cooperating Model Shop.

### The Tunnel and its Flow Characteristics

The Curtiss wind tunnel is a vertical open throat closed return of the Goettingen type with an 8′ jet diameter, and balances suspended through the floor of the room directly over the test section. A 500 hp direct current motor, driving a 12′-3″ diameter, three-blade propeller furnishes the power and is controlled by a conventional Ward Lenard system. Rheostats are operated by split field motors controlled manually with toggle switches at the main control table (no automatic velocity control has been tried because of unsuccessful attempts in other tunnels). Normal operating velocity for the majority of the testing is 100 mph, which gives the most satisfactory flow through the test section with the present setting of the deflecting vanes. For the effect of Reynolds number on the model, a range of speeds through 120 mph is used and this is approximately the maximum speed with the present propeller setting. Stepping the maximum speed up to 160 mph is to be attempted in the future with the excess power now available.

Complete flow investigations have been made in the past and the results have been favorable enough so that no changes have been necessary since the building of the tunnel. Velocity gradients show the central region of the jet to have no velocity variation. A velocity variation of $\pm .5\%$ exists towards the boundary which in one region reaches a maximum of $+1.5\%$. The largest models that can be tested do not in any part extend into any velocity variation larger than .5%.

Static pressure gradients along the test jet show 0 pressure from approximately 15″ aft of the throat to the entrance of the exit cone. Vertical and horizontal cross flow have been investigated with airfoils in the normal and inverted positions through the test section. An upward cross flow of 1.15° is present but no side cross flow can be measured. Turbulence has been measured with a 15 cm. sphere. The Reynolds number at $C_a = .3$ is 270,000 as measured in the center of the clear tunnel. The turbulence for this value is .6% which is midway between the turbulence existing in the 7.5′ M.I.T. tunnel and the 10′ *Galcit* tunnel. Manual control of velocity is satisfactory with slow periodic variations of $\pm .5\%$ to high angles of attack of the model and increasing slightly above the stall.

The manometer for indicating tunnel velocities is a ladder type krell, a counterpart of the type used at the Washington Navy Yard. Each velocity rung is at such a slope so as to give constant percent variations with equal linear movements of the fluid meniscus. The manometer is connected to four static openings on the sides of the tunnel in the pressure section, and no apparent lag between the manometer reading and the test section velocity has been noticed.

### Models

Complete airplane and wing models are made to a scale whose span will be as close to 80″ as possible. Models of this size are tested at Reynolds number above 1,000,000 and with the inherent turbulence of the tunnel, the results fall on the peak of the transition curve from laminar to turbulent flow. Models are given a high polish with only the major parts of the airplane represented. This method gives optimistic minimum drag results but allows a more reliable and constant correction to be made between the model and the completed airplane.

Cowls for the models are formed from aluminum sheet rings to accurate models of the full scale cowl. The engine is represented by a slotted disc and a diffusing screen just aft of it. Slot openings are determined by scaling down the quantity of air necessary to cool the particular full scale type of engine in climb. The quantity of air flowing through the model cowl has been determined by pressure drop across the disc and screen combination with various slot openings. Full scale

data available for determining the necessary cooling air is not accurate and other inaccuracies in model flow calculations probably introduce an error of ±10% in full scale representation on the model. No better method of representing the engine has been devised but even with a large known inaccuracy existing it seems logical that this method is superior to a random representation of the air flow through cowls. The quantity of air flowing through a cowl has a corresponding drag variation, and in the case of some nacelles, shows effect on the peak of the lift curve.

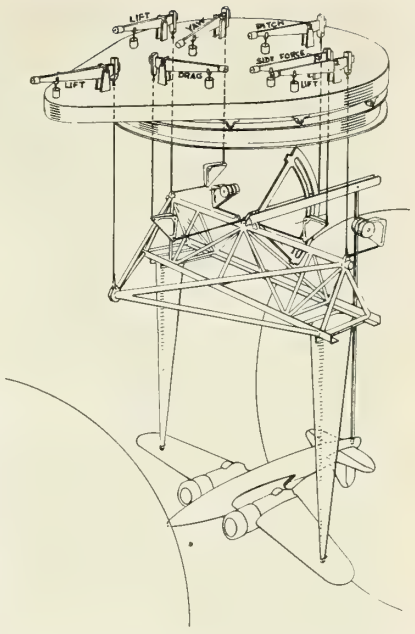
### Details of the Balance

June 1936 marked the completion of a new six-component balance unit. The result is an attempt in designing entirely for the needs of a tunnel operating in connection with an airplane factory. The fundamental characteristics designed in the order of their importance (accuracy taken for granted) are: (a) completion of routine model testing in a short time without altering the model setup; (b) confining the operation of the tunnel during tests to one man; (c) ease of changing models; and (d) flexibility of model types.

The model is rigidly supported by tapered struts at the wing connections and a single strut at the tail, a type of support selected because of its inherent ruggedness and because it can be designed to limit deflections to any desired amount. The tapered struts were designed to limit deflections to a force accuracy of ±.5% for side and drag loads on the largest model at 160 mph, the criteria carried throughout the rest of the system. Well-faired strut supports offer low set-up drag (as proven by the NACA full scale tunnel) and for this system it is 19% of the net model minimum drag for twin engine models and 26% for single engine models. The average setup drag of a wire system for comparison is 50%.

Small ball bearings are permanent in the strut ends which makes fittings in the model simple with small openings in the model surface as well as greatly reducing the time of changing models. The weights, necessary in making the struts rigid, act as a counterweight and eliminate the use of troublesome weights attached to the model. In this design the total support system weighs approximately 350 lbs. Rigidity against deflection automatically insures a steady model over the critical range of the stall. The frame or carriage and struts float on 7 conventional automatic beam type balances by means of airplane tie rods. Ease of installation resulted in the use of engine control ball bearing fittings throughout the support system up to the balances. With the long tie rods and operating the ball bearings at 1/10 their Brinelling load, no frictional forces are noticed in the system.

Beam and supports are aluminum alloy castings, with knife edges used for the fulcrums, 27" from which are the electrical contacts for reversing the split field motors. These contacts have a nominal setting of .005". The motor is mounted vertical with the counter geared directly to its shaft on top. The balance beams were designed to cover a wide range of forces without too frequent use of pan weights, and of the 7 balances the 3 main lift balances have a 75-lb. spread and the others, 40 lbs. All the counters read directly to .01 lb. Dashpots furnish the damping which can be varied by changing the orifice openings in the dashpots themselves.




*Sketch of six-component balance unit showing struts attached to rigid frame*

The base that supports the balances is a specially made aluminum alloy casting with reinforcement ribs on the underside to eliminate deflections of the balance supports. The table is in turn mounted on roller bearings which rest on a circular track mounted to a frame which is integral with the steel building beams. The table can be yawed in either direction 20° from the center location by turning a screw thus moving a nut which is attached to it. The crank for the yaw control is located just to the left of the

(*Continued on page 46*)

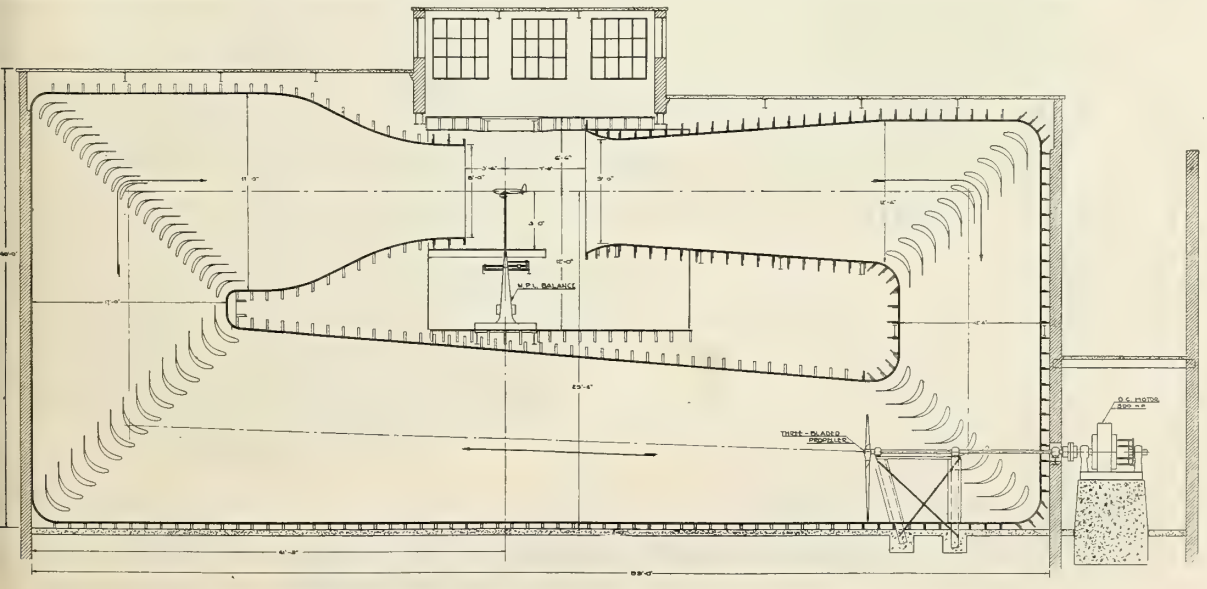
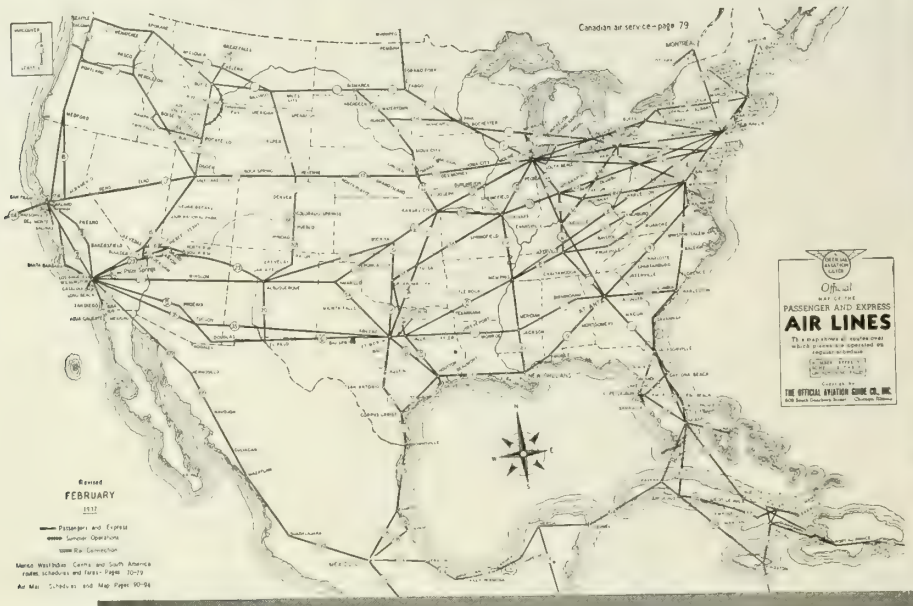
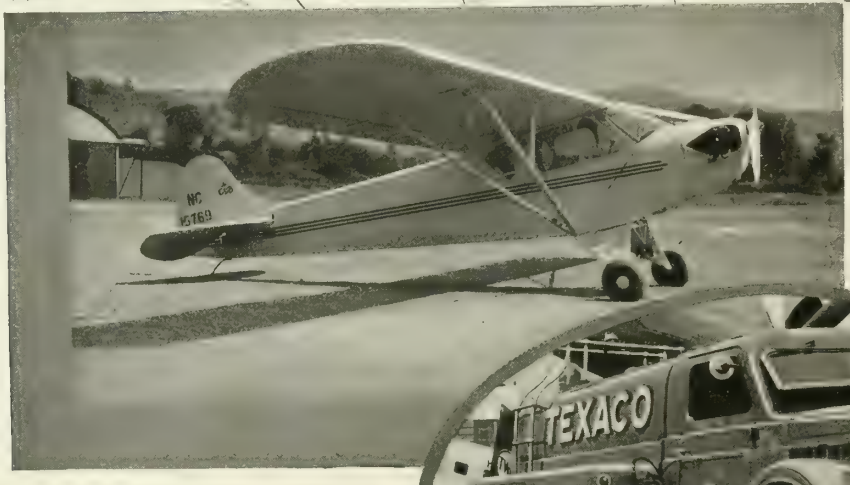



*Diagram showing cross-section of the present wind tunnel at the Curtiss Aeroplane Division*

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## List of world marks homologated by the Federation Aeronautique Internationale



● International supremacy in air records belongs to the United States by virtue of 46 records established by American pilots. The complete list of records, issued as of Oct. 1, by the F.A.I. follows. Records included subsequent to that date are supplied by AERO DIGEST.

### WORLD RECORDS

**Airline Distance:** Maurice Rossi and Paul Cordos (France); Aug. 5-7, 1933; Floyd Bennett Field, N. Y., to Rayack, Syria; Bleriot 110 (550 hp Hispano-Suiza) . . . . . 5657.387 mi.

**Closed Course Distance:** Lucien Bossoutrot and M. Rossi (France); March 23-26, 1932; Oran, Algeria; Bleriot 110 (500 hp Hispano-Suiza) . . . . . 6587.441 mi.

**Altitude:** Capt. Albert W. Stevens and Capt. Orvil Anderson (U. S. A.) Nov. 11, 1935. Rapid City to White Lake, S. D. . . . . 72,395 ft.

**Maximum Speed:** Francesco Agello (Italy); Oct. 23, 1934; Desenzano; Macchi Castoldi 72 (3800 hp Fiat AS-6V) . . . . . 440.681 mph

### INTERNATIONAL CLASS RECORDS
### Class C—Airplanes

**Airline Distance:** See World Records.

**Closed Course Distance:** See World Records.

**Broken Line Distance:** M. Rossi and P. Cordos (France); Aug. 5-7, 1933; Floyd Bennett Field, N. Y., to Le Bourget to Rhodes to Rayack, Syria; Bleriot 110 (550 hp Hispano-Suiza) 5658.400 mi.

**Altitude:** Squadron Leader F. R. D. Swain (Great Britain); Sept. 28, 1936; Farnborough; Bristol 138A (335-457 hp Bristol *Pegasus*) . . . . . 49,967 ft.

**Maximum Speed:** Howard Hughes (U. S. A.); Sept. 12, 1935; Santa Ana, Calif.; Hughes Racer (700 hp Pratt & Whitney Twin Wasp Jr.) 352.46 mph

#### SPEED OVER SPECIFIED DISTANCE (NO PAYLOAD)

**100 Kilometers** (62.137 mi.): Maurice Arnoux (France); Aug. 10, 1935; Etampes; Caudron (360 hp Renault-Bengali) . . . . . 295.968 mph

**1000 Kilometers** (621.369 mi.): Raymond Delmotte (France); Aug. 24, 1935; Istres; Caudron C-460 (360 hp Renault-Bengali) . . . . 279.948 mph

**2000 Kilometers** (1242.739 mi.): A. Biseo & G. Castellani (Italy); Sept. 23, 1935; Monte Cavo, Monte Nerone, Ansedonia; tri-motored Savoia Marchetti S-79 (Alpha Romeo) . . . . 236.742 mph

**5000 Kilometers** (2106.849 mi.): D. W. Tomlinson and J. S. Bartles (U. S. A.); May 16-17, 1935; Floyd Bennett Field, N. Y.; twin-engined Douglas DC-1 (710 hp. Wright Cyclone) . . . . . 169.031 mph

**10,000 Kilometers** (6213.698 mi.); J. LeBrix and M. Doret (France); June 7-10, 1931; Istres; Dewoitine (650 hp Hispano-Suiza) . . . . . 93.114 mph

#### RECORDS WITH PAYLOAD
#### 500 KILOGRAMS

**Speed (1000 Kilometers):** A. Biseo and G. Castellani (Italy); Sept. 23, 1935; Monte Cavo, Monte Nerome, Ansedonia; tri-motored Savoia Marchetti S-79 (Alpha Romeo) . . . . . 242.564 mph

**Speed (2000 Kilometers):** A. Biseo and G. Castellani (Italy); Sept. 23, 1935, Monte Cavo, Monte Nerone, Ansedonia; tri-motored Savoia Marchetti S-79 (Alpha Romeo) . . . . . 236.742 mph

**Speed (5000 Kilometers):** D. W. Tomlinson and J. S. Bartles (U. S. A.); May 16-17, 1935; Floyd Bennett Field, N. Y.; twin-engined Douglas DC-1 (710 hp Wright Cyclones) . . 169.031 mph

**Altitudes:** Vladimir Kokkinaki (Russia); Aug. 3, 1936; Moscow; twin-engined CKB-26 (800 hp M-85) . . . . . 43,234.38 ft.

#### 1000 KILOGRAMS

**Speed (1000 Kilometers):** A. Biseo and G. Castellani (Italy); Sept. 23, 1935; Monte Cavo, Monte Nerone, Ansedonia; tri-motored Savoia Marchetti S-79 (Alpha Romeo) . . . . . 242.564 mph

**Speed (2000 Kilometers):** A. Biseo and G. Castellani (Italy); Sept. 23, 1935; Monte Cavo, Monte Nerone, Ansedonia; tri-motored Savoi Marchetti S-79 (Alpha Romeo) . . . . . 236.742 mph

**Speed (5000 Kilometers):** D. W. Tomlinson and J. B. Bartles (U. S. A.); May 16-17, 1935; Floyd Bennett Field, N. Y.; twin-engined Douglas DC-1 (710 hp Wright Cyclones) . . 169.031 mph

**Altitude:** Vladimir Kokkinaki (Russia); Aug. 21, 1936; Moscow; twin-engined CKB-26 (800 hp M-85) . . . . . 35,560.96 ft.

#### 2000 KILOGRAMS

**Speed (1000 Kilometers):** A. Biseo and G. Castellani (Italy); Sept. 23, 1935; Monte Cavo, Monte Nerone, Ansedonia; tri-motored Savoia Marchetti S-79 (Alpha Romeo) . . . . . 242.564 mph

**Speed (2000 Kilometers):** A. Biseo and G. Castellani (Italy); Sept. 23, 1935; Monte Cavo, Monte Nerone, Ansedonia; tri-motored Savoia Marchetti S-79 (Alpha Romeo) . . . . . 236.742 mph

**Altitude:** Nicola diMauro and Giorgio Olivari (Italy); May 12, 1934; Montecelio, Rome; tri-motored Savoia Marchetti S-72 (Pegasus S-2) 27,683.643 ft.

#### 5000 KILOGRAMS

**Altitude:** Lucien Coupet (France); June 16, 1934; Toussusle-Noble; four-engined Farman F.221 (Gnome & Rhone K14RSD) . . . . . 21,814.239 ft.

#### 10,000 KILOGRAMS

**Altitude:** Majors A. Youmacheff and Kalachnikoff (Russia); Sept. 16, 1936; Chelkovo; four-engined ANT-6 (800 hp AM-3) . . . . . 21,669.68

**Greatest payload carried to an altitude of 2000 meters** (6561.66 ft.): Major A. Youmacheff (Russia); Sept. 20, 1936; Chelkovo; four-engined ANT-6 (800 hp AM-34) . . . . 26,455.20 lbs.

#### LIGHT AIRPLANES—FIRST CATEGORY
*(multi-place, empty weight less than 1234.576 lbs.)*

**Airline Distance:** Robert B. Buck and Lee Bellingraph (U. S. A.); May 5-6, 1936; Burbank, Calif. to Columbus, Ohio; Monocoupe (90 hp Lambert . . . . . 1987.077 mi.

**Altitude:** Renato Donati and (passenger) M. Lanciani (Italy); Dec. 30, 1932; Littorio Airport, Rome; Fiat ASI c.n.a. (CNAc) . . . . . 30,453 ft.

**Speed (100 Kilometers):** M. Arnoux and Mme. Becker (France); Aug. 8, 1935, Etampes; Caudron 450 (Renault) . . . . . 281.942 mph

**Speed (1000 Kilometers):** M. Arnoux and Mlle. Lallus (France); Sept. 9, 1936; Etampes-Chartes-Ronce; Caudron C-450 (140 hp Renault) . . 248.752 mph

#### LIGHT AIRPLANES—SECOND CATEGORY
*(one-place, empty weight less than 992.070 lbs.)*

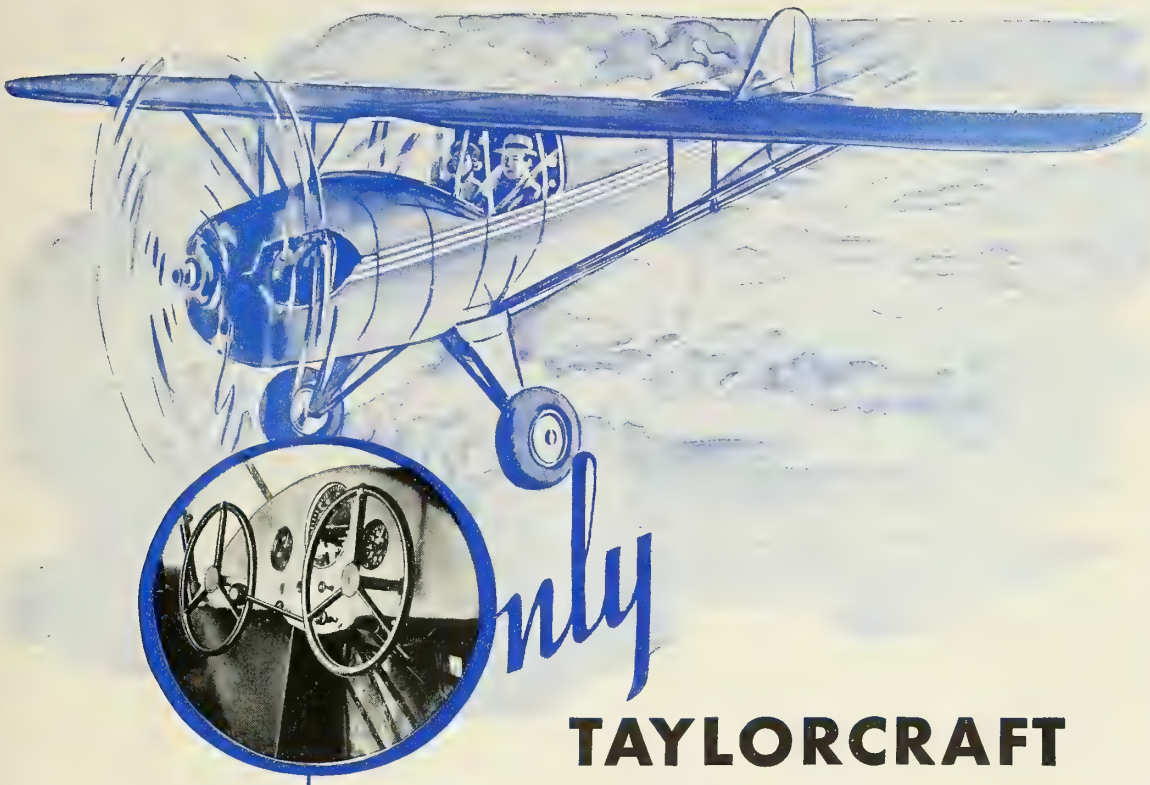
**Airline Distance:** Capt. Skarzinski (Poland); May 7, 1933; St. Louis, Senegal to Maceio, Brazil; RWD 5bis (130 hp Gypsy Major) . . . 2225.747 mi.

**Altitude:** Furio Nicolet (Italy); Dec. 24, 1933; Littorio Airport, Rome; E.T.A. (160 hp CNA) . . . 32,834.546 ft.

**Speed (100 Kilometers):** Rudolph A. Kling (U. S. A.); July 4, 1936; Denver, Colo.; Keith Rider Special (272 hp Menasco) . . . . . 227.804 mph

**Speed (1000 Kilometers):** Raymond Delmotte (France); Dec. 26, 1933; Istres; Caudron 362 (150 hp Renault-Bengali) . . . . . 206.834 mph

*(Continued on page 37)*



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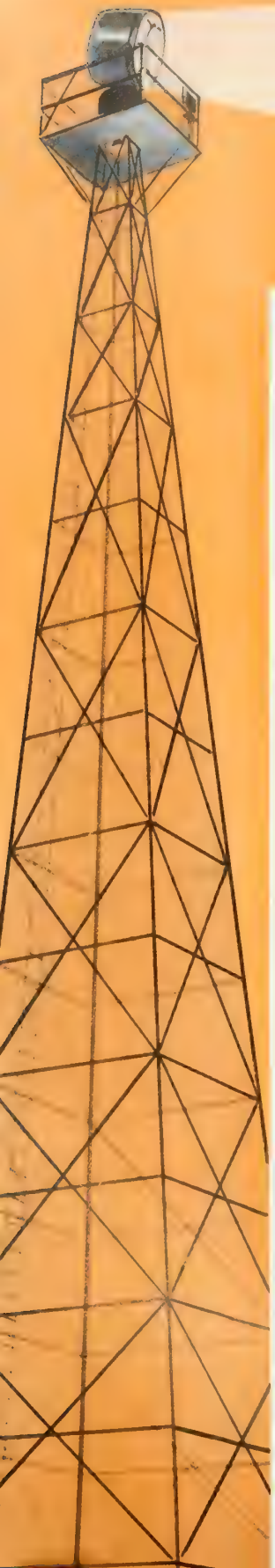
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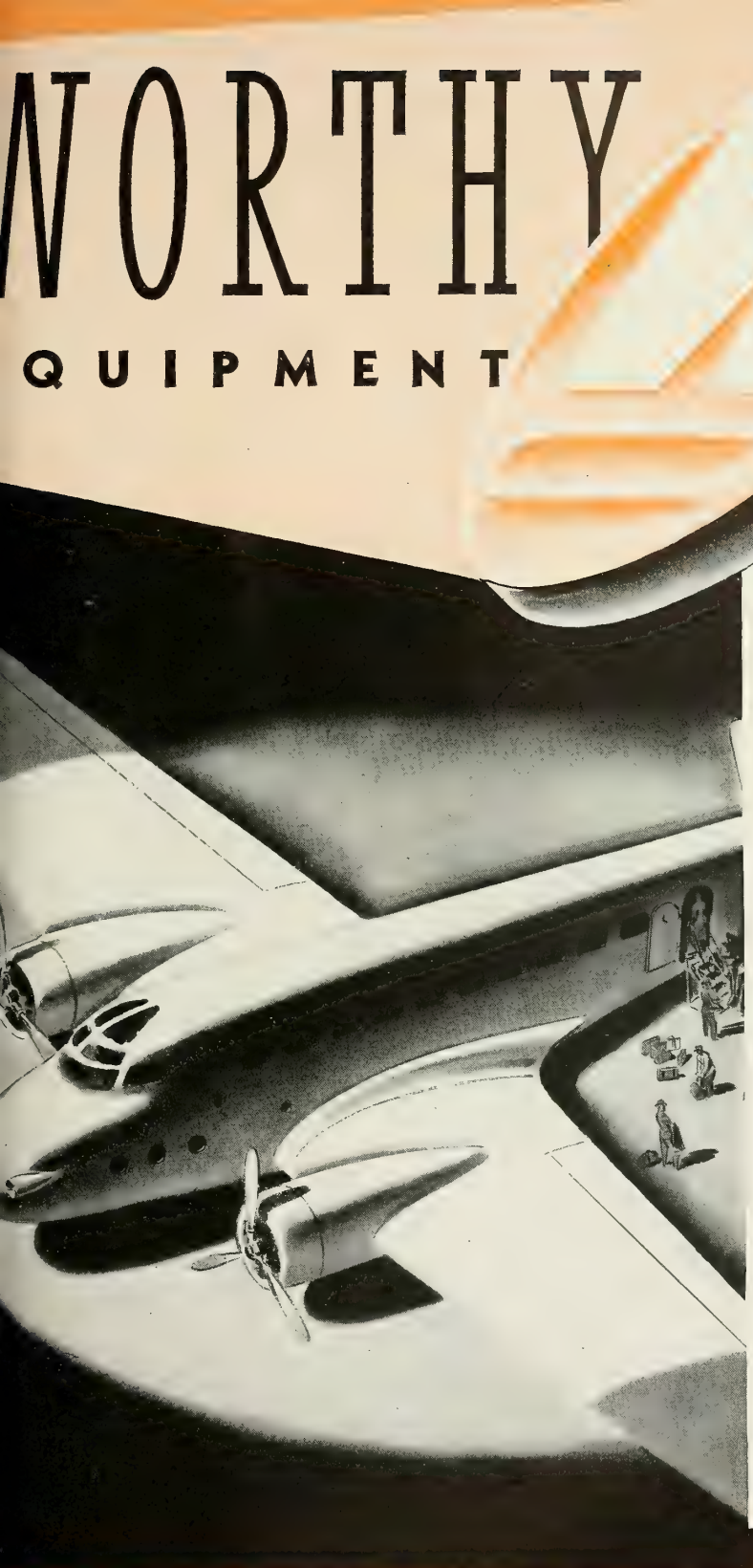
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This picture shows a battery of control and recording instruments used for heat treatment of aircraft forgings produced by Aluminum Company of America. Temperature is held within a range of plus or minus 10° Fahrenheit. This illustrates the careful control of manufacturing processes that insures the high standards of Alcoa Aluminum Alloys.

The procedure is another example of the way in which laboratory findings are applied with precision in Alcoa plants. Thus Aluminum's strength, lightness, resistance to corrosion, and heat conductivity are made available in highest degree for improving plane and engine design. (*Note in the photograph that instrument panels are mounted on protective spring suspension.*)

ALCOA ALUMINUM

(*Continued from page 32*)

**LIGHT AIRPLANES—THIRD CATEGORY**
*(multi-place, empty weight less than 617.288 lbs.)*

**Airline Distance:** Capt. J. Polma and Lieut. F. Zeleny (Czechoslovakia); May 27, 1936; Prague to Moscow; Praga E-114 (36 hp Praga B-29) . . . . . 928.261 mi.

**Altitude:** Giovanni Zapatta and (passenger) Ragus Francesco (Italy); Dec. 2, 1933; Montecelio, Rome; N-5 (75 hp Pobjoy) . . . . . 22,805.049 ft.

**Speed (100 Kilometers):** Sebastiano Bedendo and Rinaldo Stenico (Italy); Feb. 17, 1935; Littoria Airport, Rome; N-5 (75 hp Pobjoy) . . 138.303 mph

**Speed (500 Kilometers):** Sebastiano Bedendo and Rinaldo Stenico (Italy); Feb. 16, 1935; Littoria Airport, Rome; N-5 (75 hp Pobjoy . . 133.771 mph

**Speed (1000 Kilometers):** M. Bailey and M. Reginensi (France); Oct. 4, 1933; Villesauvage-La Marmogne; Farman 239 (75 hp Pobjoy) . . . . . 121.639 mph

**LIGHT AIRPLANES—FOURTH CATEGORY**
*(one-place, empty weight less than 440.920 lbs.)*

**Airline Distance:** G. Fauvel (France); Sept. 10, 1929; St. Inglebert to Pau; Maubaussin-Peyret 10 (ABC Scorpion) . . . . . 529.469 mi.

**Altitude:** Benjamin King (U. S. A.); April 24, 1936; Langley Field, Va.; Aeronca (36 hp Aeronca E-113 A) . . . . . 17,939.414 ft.

**Speed (100 Kilometers):** S. J. Wittman (U. S. A.); Feb. 14, 1934; New Orleans, La.; Wittman Special (75 hp Pobjoy) . . . . . 137.513 mph

**Speed (500 Kilometers):** Benjamin King (U. S. A.); April 26, 1936; Hampton Roads, Va.; Aeronca C-2 (36 hp Aeronca E-113 A) . . . 74.82 mph

## Class C-2—Seaplanes

**Airline Distance:** Lieut. Comdr. Kneffler McGinnis and Lieut. J. K. Averill (U. S. A.); Oct. 14-15, 1935; Coco Solo, Canal Zone to San Francisco, Calif.; twin-engined Consolidated flying boat XP3Y-1 (825 hp Pratt & Whitney Twin Wasp Jrs.) . . . . . 3,300 mi.

**Broken Line Distance:** Lieut. Comdr. Kneffler McGinnis and Lieut. J. K. Averill (U. S. A.); Oct. 14-15, 1935; Coco Solo, Canal Zone to San Francisco, Calif.; twin-engined Consolidated flying boat XP3Y-1 (825 hp Pratt & Whitney Twin Wasp Jrs.) . . . . . 3,450 mi.

**Altitude:** Lieut. A. Soucek (U. S. A.); June 4, 1929; Washington, D. C.; Wright Apache (450 hp Pratt & Whitney) . . . . . 38,559.594 ft.

**Maximum Speed:** See World Records.

**SPEED OVER SPECIFIED DISTANCE (NO PAYLOAD)**

**100 Kilometers:** Guglielmo Cassinelli (Italy); Oct. 8, 1933; Falconara-Pesaro; Macchi C-72 (2400 hp Fiat AS6) . . . . . 391.072 mph

**1000 Kilometers:** Mario Stoppani and Amelio Novelli (Italy); July 7, 1936; Ansedonia-Antignano; tri-motored Cant Z-506I (Fiat A-59R) 194.66 mph

**2000 Kilometers:** Mario Stoppani and Amelio Novelli (Italy); July 7, 1936; Ansedonia-Antignano; tri-motored Cant Z-506I (Fiat A-59R) 190.963 mph

**5000 Kilometers:** Lieut. de vaisseau Paris and M. Gonord (France); June 4-5, 1931; Archachon; Latecoere 28-3 (600 hp Hispano-Suiza) . 86.723 mph

**RECORDS WITH PAYLOAD**
**500 KILOGRAMS**

**1000 Kilometers:** Mario Stoppani and Amelio Novelli (Italy); July 7, 1936; Ansedonia-Antignano; tri-motored Cant Z-506I (Fiat A-59R) 194.66 mph

**2000 Kilometers:** Mario Stoppani and Amelio Novelli (Italy); July 7, 1936; Ansedonia-Antignano; tri-motored Cant Z-506I (Fiat A-59R) 190.963 mph

**Altitude:** M. Bourdin (France); Jan. 26. 1934; Antibes; twin-engined Liore and Olivier (690 hp Hispano-Suizas) . . . . . 31,272.871 ft.

**1000 KILOGRAMS**

**1000 Kilometers:** Mario Stoppani and Amelio Novelli (Italy); July 7, 1936; Ansedonia-Antignano; tri-motored Cant Z-506I (Fiat A-59R) 194.66 mph

**2000 Kilometers:** Mario Stoppani and Amelio Novelli (Italy); July 7, 1936; Ansedonia-Antignano; tri-motored Cant Z-506I (Fiat A-59R) 190.963 mph

**Altitude:** M. Bourdin (France); Dec. 26, 1933; Antibes; twin-engined Liore and Olivier (690 hp Hispano-Suizas) . . . . . 29,081.277 ft.

**2000 KILOGRAMS**

**1000 Kilometers:** Mario Stoppani and Amelio Novelli (Italy); July 7, 1936; Ansedonia-Antignano; tri-motored Cant Z-506I (Fiat A-59R) 194.66 mph

**2000 Kilometers:** Mario Stoppani and Amelio Novelli (Italy); July 7, 1936; Ansedonia-Antignano; tri-motored Cant Z-506I (Fiat A-59R) 190.963 mph

**Altitude:** M. Bourdin (France); Jan. 3, 1934; Antibes; twin-engined Liore and Olivier (690 hp Hispano-Suizas) . . . . . 24,629.190 ft.

**5000 KILOGRAMS**

**Altitude:** Boris Sergievsky and Raymond B. Quick (U. S. A.); May 17, 1934; Bridgeport, Conn.; four-engined Sikorsky S-42 (670 hp Pratt & Whitney Hornets) . . . . . 20,406.762 ft.

**Greatest Payload carried to an altitude of 6,561.660 ft.:** Boris Sergievsky (U. S. A.); Apr. 26, 1934; Bridgeport, Conn.; four-engined Sikorsky S-42 (670 hp Pratt & Whitney Hornets) . . . . . 16.608 lbs.

**LIGHT SEAPLANES—FIRST CATEGORY**
*(multi-place, empty weight less than 1499.128 lbs.)*

**Airline Distance:** Henry W. Borntraeger and Edward H. Strafford (U. S. A.); Mar. 28, 1936; Viking Airport, Miami, Fla., to Daytona Beach; Kitty Hawk (125 hp Kinner) . . 241.711 mi.

**Altitude:** Furio Niclot and (passenger) Mariano Lanciani (Italy); Dec. 28, 1932; Littoria seaplane base, Rome; Fiat A.S.I.C.N.A. (CNA C-7) . . . . . 24,153.470 ft.

**Speed (100 Kilometers):** Gian Giancomo and Rosetti Domenico (Italy); May 6, 1936; Faro di Anzio; ETA-CNA (150 hp CNA-C6) . . . . . 122.853

**LIGHT SEAPLANES—SECOND CATEGORY**
*(one-place, empty weight less than 1256.622 lbs.)*

**Airline Distance:** Benjamin King (U. S. A.); June 25, 1935; Port Washington, N. Y., to Anacostia, D. C.; Aeronca C-3 seaplane (36 hp Aeronca E II 3A) . . . . . 219.959 mi.

**Altitude:** Furio Niclot (Italy); Nov. 6, 1933; Littorio Airport, Rome; E.T.A. C.N.A. (160 hp C.N.A. C-7) . . . . . 27,595,061 ft.

**Speed (100 Kilometers):** Alfred Grundke (Germany); June 13, 1930; Dessau; Junkers J 50-W seaplane (85 hp Armstrong Siddeley Genet) . . . . . 102.544 mph

**LIGHT SEAPLANES—THIRD CATEGORY**
*(multi-place, empty weight less than 771.610 lbs.)*

**Airline Distance:** Benjamin King (U. S. A.); June 16, 1935; North Beach, N. Y., to Whitney's Landing, Md.; Aeronca C-3 seaplane (36 hp Aeronca E II 3A) . . . 185.398 mi.

**Altitude:** Terris Moore and Mrs. Terris Moore (U. S. A.); Feb. 1, 1936; Boston, Mass.; Aeronca C-3 (36 hp Aeronca E-113 B) . . . 11,558.258 ft.

**Speed (100 Kilometers):** Jean de Viscaya and M. Chaudet (France); June 26, 1931; Le Pecq-Bonnieres-Le Roule; Farman 230 (40 hp Salmson) . . . . . 89.191 mph

**LIGHT SEAPLANES—FOURTH CATEGORY**
*(one-place, empty weight less than 551.150 lbs.)*

**Airline Distance:** Benjamin King (U. S. A.); Sept. 26, 1935; Anacostia, D. C.—Croton-on-Hudson, N. Y.; Aeronca C-2 seaplane (36 hp Aeronca E II 3A) . . . . . 230.325 mi.

**Altitude:** Benjamin King (U. S. A.); Sept. 24, 1935; Anacostia, D. C.; Aeronca C-3 seaplane (36 hp Aeronca E II 3A) . . . . . 15,082 ft.

**Speed (100 Kilometers):** Benjamin King (U. S. A.); Dec. 11, 1935; Miami, Fla.; Aeronca C-3 seaplane (36 hp Aeronca E II 3A) . . . . 80.931 mph

**Speed (500 Kilometers):** Benjamin King (U. S. A.); Dec. 11, 1935; Miami, Fla.; Aeronca C-3 seaplane (36 hp Aeronca E II 3A) . . . . 70.502 mph

(*Continued on page 96*)

# EDITORIALS

★

**"The passenger has become a more important revenue factor than either mail or express. More attractive passenger accommodations can be provided as the size of the airplane increases, and improvement in passenger comfort will cause an increase in passenger volume. Larger aircraft represent an improved performance and an increase in safety, for the greater number of power plants decreases the possibilities of unscheduled landings, the number of normal landings is reduced due to the longer range of the larger craft, it is more independent of weather conditions, and is capable of carrying more extensive radio and flight facilities."**
***H. O. West, Supt. of Engineering, United Air Lines***

## ICC Control Imperative

The air transport industry in this country has been buffetted about by the Government for many years. Its close association with the Post Office Department undoubtedly had much to do about it, for politics reigns to a greater degree in this department than any other in politics-ridden Washington. Control by the Department of Commerce also offers no relief to the industry in this respect.

A way out for the airlines, however, may be in sight. Congressman Crosser of Ohio introduced H. R. 4652, more academically known as the Air Line Safety Act of 1937, the general purpose of which is to transfer to the Interstate Commerce Commission all regulations directly concerning airline safety. The regulation of non-scheduled miscellaneous operations, schools and private flying are left just as they are. The I.C.C. is to designate the airways, prescribe the aids and facilities to be used on them and promulgate traffic rules governing their use, but the actual construction, operation and maintenance of the physical apparatus will remain as at present. Weather observations and reporting also will continue to be handled by the agency now doing such a splendid job—the Weather Bureau of the Department of Agriculture.

Most important, the bill provides for the establishment of a Bureau of Air Transport within the I.C.C.—entirely independent of the rail and motor carriers, and for the withdrawal of airline regulation and control from the Bureau of Air Commerce.

I.C.C. control of the airlines should remove the most serious obstacle to the continued progress of the air transport industry in this country—politics. Air transport operators and their personnel are strongly in favor of the adoption of Congressman Crosser's bill for they know they will get a square deal from an unbiased, unpolitical tribunal.

## Too Many Aircraft Shows

Aircraft shows usually have served useful purposes and will continue to have a necessary place in the aviation industry as they have in the automobile industry. But our industry has not yet reached the point where it can afford to support exhibits in every large city. The time may come when such a series of demonstrations will be desirable, but that is a long time off.

The success of the New York and Los Angeles expositions seems to have been an incentive to other groups in various parts of the country. As there has been a decided increase in airmindedness, evidenced by the shows already held this year, covetous promoters want to take advantage of the situation and stage additional shows. They care not that aircraft and engine manufacturers have their own work to do, and that it costs them more to exhibit their products than they can hope to get in return.

At present two shows a year are sufficient. One exhibit on the east coast and another on the west coast admirably suits the purposes of the industry although one should be held in the fall, the other in the spring, thus giving exhibitors a breathing spell between. Attempts to stage a continuous chain of exhibitions in all sections of the country impose on the manufacturers.

The Aeronautical Chamber of Commerce Show Committee is in an advantageous position to adjust this situation by withholding sanctions.

## Speed Requires Less Red Tape

Development of international air transportation, in addition to its engineering and navigational problems, is faced with numerous restrictions and regulations, which threaten seriously to hamper its growth.

Forbidden zones, flying authorizations that are complicated and somewhat difficult to obtain, burdensome customs regulations and excessive formalities, passport and visa requirements, are only a few of the administrative obstacles with which the airline companies must cope. They all militate against a most essential factor in air transport—speed.

Development is also retarded by excessive import duties on aircraft and parts as well as fuel.

These difficulties in international air travel do not strike home—yet. But soon American airplanes will be flying across the Atlantic carrying American passengers, and any unnecessary restrictions on the operating companies or their passengers will further complicate an already-complicated problem.

A liberal attitude in the matter of regulations will enable the public to obtain the full benefit from this new, but proven, means of transport, and permit the operating companies to concentrate to a greater extent on the many technical problems associated with developments of such magnitude.

## State Aviation Legislation

Politicians still try to make a "good thing" of aviation and, regardless of what effect their bills will have on flying activities, are persisting in their endeavors to tie-up with and benefit themselves from this newest method of transportation.

Various pieces of legislation crop up in state and the national houses with regularity. Ominous because of the great number proposed, only isolated bills really aim at improving and benefiting aviation.

Most flagrant violators of faith with aviation are those bills calling for state aviation commissions. These usually provide for plenty of so-called "jobs" with high sounding titles, nice salaries and little or no work.

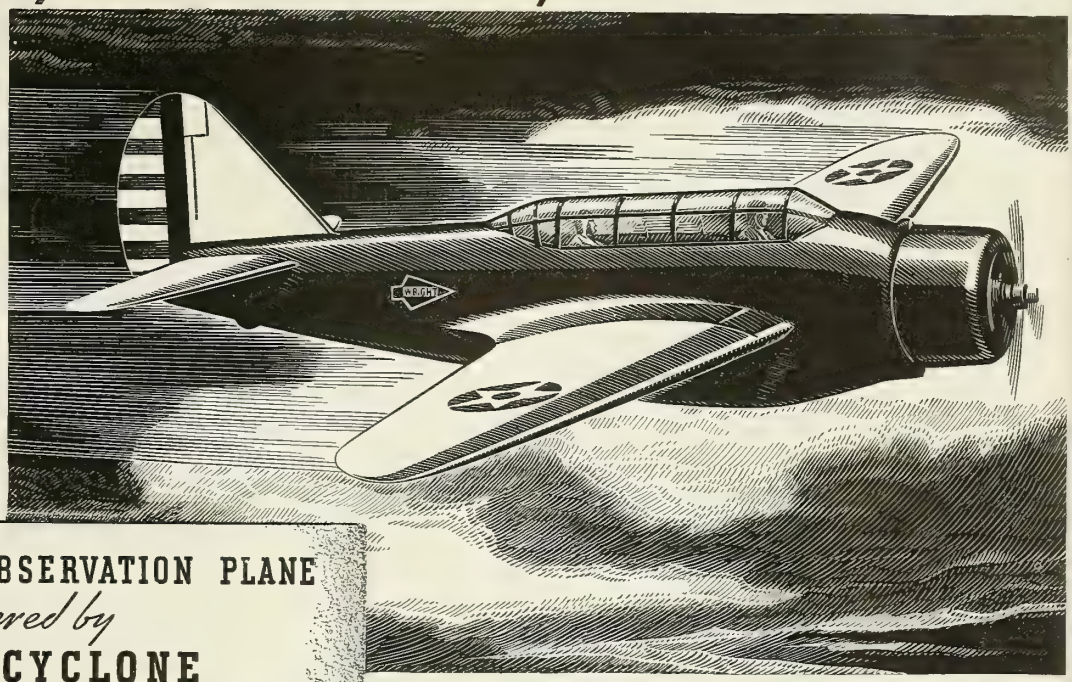
Flying is not the exclusive concern of the state; airplanes are seldom confined to intra-state activity. Even more than the automobile and railroad, the airplane has outmoded state borders.

We have too much regulation of aviation already. The Bureau of Air Commerce wields sufficient regulation and control without the origination and imposition of additional handicaps within the individual states.

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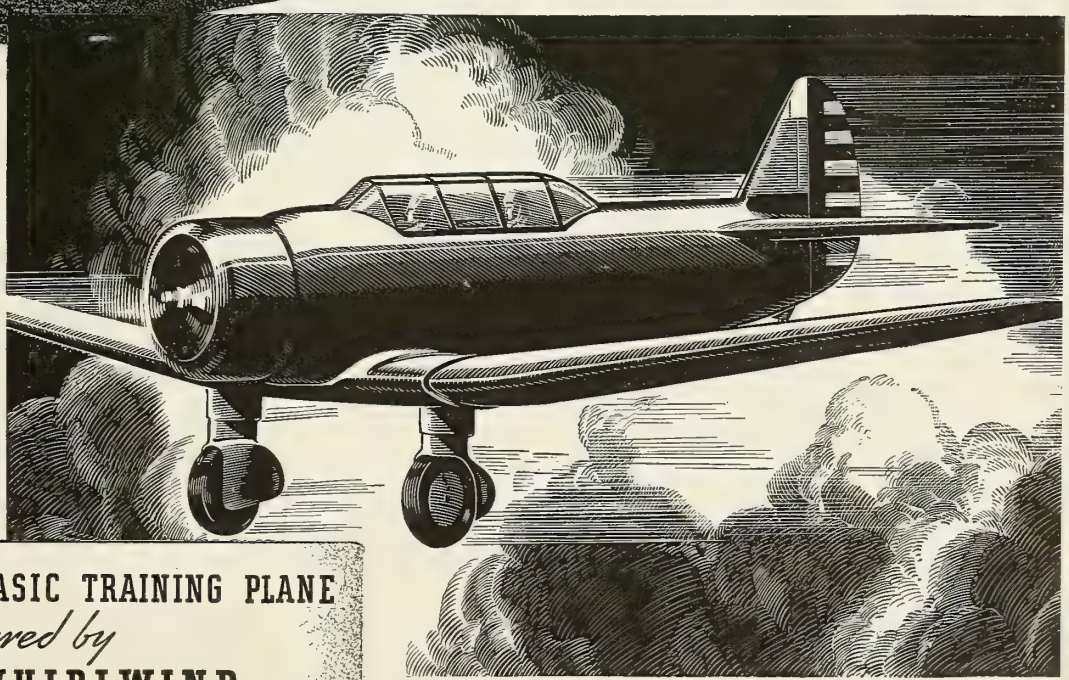
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# Airplane Flight to and in the Stratosphere

## PART II

RUSSELL J. SMITH

● The propeller is an important part of the problem of airplane flight in the stratosphere. If a source of brake horsepower is available, it remains for the propeller to transform it into thrust horsepower or horsepower available. The previous article (AERO DIGEST, Dec. 1936) cited the methods with possibilities of keeping the sea level brake horsepower from diminishing up to and in the stratosphere. In this article, the propeller part of the power available question will be studied.

The propeller acting in the stratosphere should do as much to transform the brake horsepower there into thrust horsepower as it did at lower altitudes. An interpretation of the following propeller formulas would indicate, in a general way, the characteristics a propeller might have for operation in the stratosphere:

$T = C_t \rho n^2 D^4$

$\eta = \tan\phi/\tan(\phi+\gamma)$

$\eta$max. when $\phi = 45° - \gamma/2$

The first equation indicates that with increasing altitude, decreasing density, the thrust of the propeller can be kept up by increasing $Ct$, $n$ or $D$. Assuming, as in previous sections, that the engine is run at its rated rpm and rated hp, from sea level on up to the stratosphere, any subsequent increase in rpm would result in speeding the engine beyond a safe limit and shortening its life. This would probably be prohibitive. Also, in regard to $D$, it is generally believed that a variable-diameter propeller, that is practically usable, would be difficult to produce.

The solution of the problem seems to be in the use of a variable-pitch propeller. The amount of increase in the pitch, however, is limited as indicated in the third formula. An extremely high pitch would result in little thrust, only paddling of the air. Since the increase in pitch is limited, propellers for operation in the stratosphere would probably be of large diameter and have more than two blades in order to maintain a grip on the air of lower density. Such characteristics could be offset in the denser air of lower altitudes by a decrease in pitch. It would seem possible to obtain a higher propeller efficiency in flying in the stratosphere due to the realization of high speeds and consequent increase in $V/ND$ values. Such questions might be answered by data obtained from experimental flights.

With a variable-pitch propeller a stratoplane could take off at sea level and run its engine at the rated rpm and rated hp without slowing it down at the lower levels or racing it at the higher altitudes. In this way when the level of flying in the stratosphere has been reached, the propeller pitch has gradually increased so that it then operates at a condition of maximum efficiency.

The effect of tip speed on propeller efficiency is mentioned here as part of the problem. It has been found that metal propellers have a sudden loss of efficiency when the tip speed goes above .9 of the speed of sound in air. The velocity of sound in air varies approximately as the square root of the absolute temperature but is independent of pressure. There is then some variation with altitude due to a temperature change; from 1160 ft./sec. at 100° F. to 1050 ft./sec. at 0° F. (1)

Engines would probably need to be geared for driving propellers in stratoplanes.

Probable increases in the empty weight of a stratoplane, among other things, might be expected from the propeller, the engine, a longer landing gear, and structure to overcome torque.

The advent of variable-pitch propellers on the market has given impetus to the work on flight in the stratosphere.

### Cabin of Stratoplanes

A new and different type of problem to be met in the design of a stratoplane is that of the cabin. The cabin of a stratoplane would probably need to be air-tight. The human machine cannot survive at great altitudes, even if supplied with oxygen for breathing and electrically heated flying suits for warmth, on account of the reduction in pressure to which the body is not accustomed. It would seem necessary, at great altitude, to keep passengers under artificially created living conditions, such as the pressure and temperature of the air, which are similar to those under normal conditions. These might not necessarily need to be created immediately on leaving sea level as man can live in comfort at 10,000 ft., and this might be considered a starting point. This factor would have influence on the weight and design of the cabin of the stratoplane. A pressure cabin of some type would seem to be the solution.

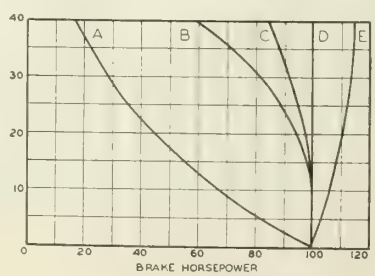
A pressure cabin of this type, due to the higher pressure inside than out, would tend to burst outward. Such a condition would tend to put the walls of the cabin in tension, thus influencing design. An opposite problem is met in submarine design.

Difficulty has been encountered in obtaining airtightness of these pressure cabins. Sources of leakage which need to be air-tight are the entrance and exit opening to the cabin, as well as points where controls must pass through walls of the cabin. A source of danger are the windows which are subject to breakage due to temperature changes as well as pressure differences. Temperature changes also affect other parts of the structure.

Controls of many airplanes, on ascending to high altitudes, have stiffened and sometimes become completely jammed. This was thought to be due to the effect of the lower temperature at such levels (a) on the viscosity of lubricants used for the controls; (b) in causing unequal contractions of the airplane components; and (c) in subsequent freezing of moisture deposited on bearings and levers at lower altitudes. Lubricants for low temperature operation are receiving much study, especially in connection with winter auto driving, and much is being learned. Thoughts are also turned to the development of bearings that work without lubricant. Unequal contraction, when investigated mathematically, has been found to cause almost negligible stiffening in the range of temperatures encountered. The matter of deposition of moisture, depending on humidity which varies widely, is difficult to overcome. Reducing bearing areas or using fulcrum devices suggest themselves as remedies. (2) There are probably many problems of original nature, similar to this, which will present themselves after experimental flight in the stratosphere.

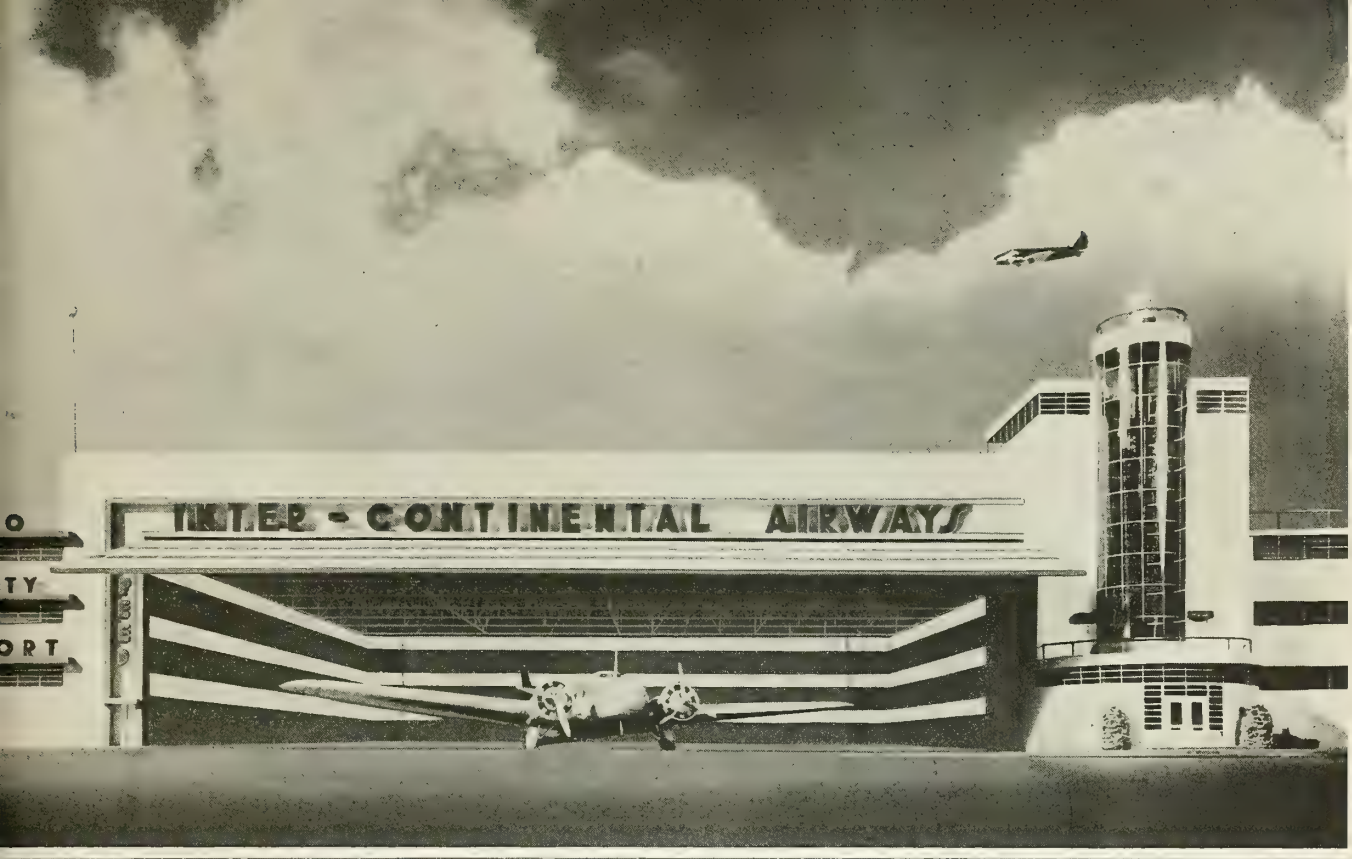
In general, it would seem that the design of a pressure cabin for a stratoplane would allow much room for the use of ingenuity. It is this part of the design that would have much to do with the weight and performance of a stratoplane.

[1] Fred S. Weick, *Aircraft Propeller Design.*




*Graph showing superchargers (Net engine power) A—Unsupercharged engine; B—Roots; C—Geared-centrifugal or vane type; D—Turbo-supercharger; E—Total power developed carb. press. 29.92" Hg. exhaust press. atmospheric*

[2] Major Stewart. *High Altitude Equipment of Aircraft;* The Journal of The Royal Aeronautical Society, May 1930.




# CLEAR SPANS



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THE AUSTIN METHOD

# Span-Lift Distribution

DR. MAX M. MUNK

**Referring to the accompanying article, the technical section of the Manufacturing Inspection Service, Bureau of Air Commerce, says: "The subject of span distribution has become quite important recently due to the increasing use of wings having relatively high taper in plan form. In many cases twist is also employed. The effects of taper are important because of the resulting increase in lift toward the tip, which not only increases wing bending loads, but also is conducive to wing-tip stalling. Most methods which have been proposed to compute span distribution are laborious and confusing. We believe that the general method of attack used by Dr. Munk, on account of the practical aspects of his method, offers promise as a suitable engineering method and it should prove to be extremely helpful to airplane designers."**

● Recent American papers on the computation of the span-lift distribution, such as NACA TR 572 (R. F. Anderson), NACA TN 589 (Pearson), and similar collateral work, employ mathematical methods which may be characterized as too narrow for their purpose, and may not offer a scientifically sound, broad and general basis for determining the load distribution and balance.

In absence of any reference to this important aspect in these papers, it is necessary to point out that these methods refer primarily to a straight span line only—to airfoils having no sweepback. This holds true for the method employing Fourier series, ascribed to H. Glauert and for Miss Lotz in the above papers. Any noticeable, although moderate, sweepback in this connection, however, cannot be disregarded, inasmuch as the influence of the sweepback on the span lift distribution is pronounced and prominent, and as large as the influence of the other airfoil dimensions. Sample airfoils analyzed in the above report represent wings with a pronounced and immoderate sweepback.

It is misleading to apply the straight span method to such airfoils, for which the method does not hold at all. There is one exception to this limitation—if the problem is directed to the computation of the induced drag associated with a given span-lift distribution. In that case, the actual swept back span and its lift distribution may be replaced by a fictitious straight span with the same distribution, and the fictitious (not actual) corresponding straight-span induced downwash distribution can then be determined. This fictitious downwash together with the fictitious straight lift then gives the correct induced drag. Each lift increment is multiplied by its downwash and the products summed up. The result is correct because the induced drag is independent of the lengthwise location of the lift, a special theorem introduced 20 years ago by the author and reprinted as NACA TR 121. It can therefore be stated that the theorem is limited to the total induced drag and does not extend to the local values of the downwash or of the induced drag.

It would be erroneous to disregard the sweepback for the computation of the distribution of the local downwash. This is by no means warranted, neither by fact nor by theory. On the contrary, a sweepback of the wings brings about a concentration of the downwash in the central portion of the airfoil, the same being in the order of magnitude of $1 + \sin \delta$, where $\delta$ denotes the sweepback angle. This concentration or augmentation of the downwash near the center is compensated by a diminishment of the downwash at the outer portions of the airfoil, whereby the lift loading is diminished near the wing roots and increased near the wing tips.

It follows that unless there is actually no or a really insignificant sweepback, the application of the wing theory to the computation of the span lift distribution must be postponed until theory has advanced to the point of taking due account of the sweepback and its influence on the lift distribution, and that in a manner involving a reasonable and not an excessive amount of work.

### Diagrams for the Straight Span

As a first step towards that goal, a short method for the determination of the downwash from the span lift distribution in absence of sweepback, will be described. It is proposed to perform this work by the use of diagrams, such as indicated in the accompanying illustrations.

Preparatory to the use of these diagrams, the known or assumed span lift distribution is plotted on tracing paper. The scale of the span has to be such that it becomes as long as indicated in the diagram. The lift per unit length divided by the dynamic pressure is plotted in the same scale against that span.

The basis of this lift plot is then brought in coincidence over and with the basis of figure 1. Of all the ellipses of this diagram, or the many others which supplement it by way of interpolation, the one chosen intersects with the lift plot at the point of the span for which it is intended to determine the downwash. This ellipse is traced. The number in figure 1 corresponding to that ellipse represents downwash in .001 radian.

Attention is then focused on the areas lying between the lift plot and the traced ellipse. Those below the ellipse are considered positive; the others negative.

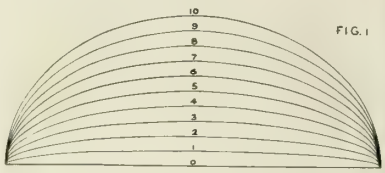


FIG. 1

The plot is now placed on top of figure 2 (the bases coinciding), such that the center point of the basis of figure 2 coincides with the point of the span of the plot for which the downwash is to be determined. Now count out the squares of figure 2 covered by the areas between lift plot and ellipse, using fractions where necessary, and giving due regard to whether the areas are positive or negative. The result (it may be positive or negative) also gives the downwash angle, in .001 radian.

Finally, draw the two chords connecting the intersections with the middle or inside ordinates of figure 2 with either the lift plot or the ellipse. The length of the portion of the center ordinate of figure 2 lying between the two chords, and measured in the scale indicated in the diagram, again shows downwash angle in .001 radian. It is positive if the

(*Continued on page* 94)

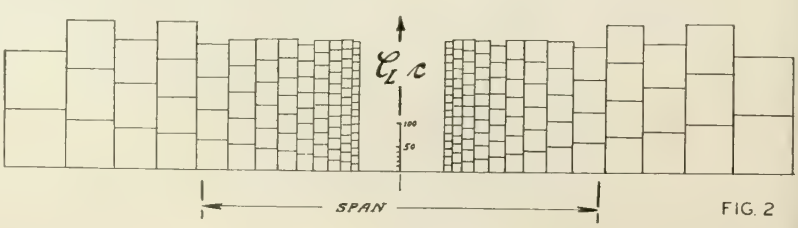
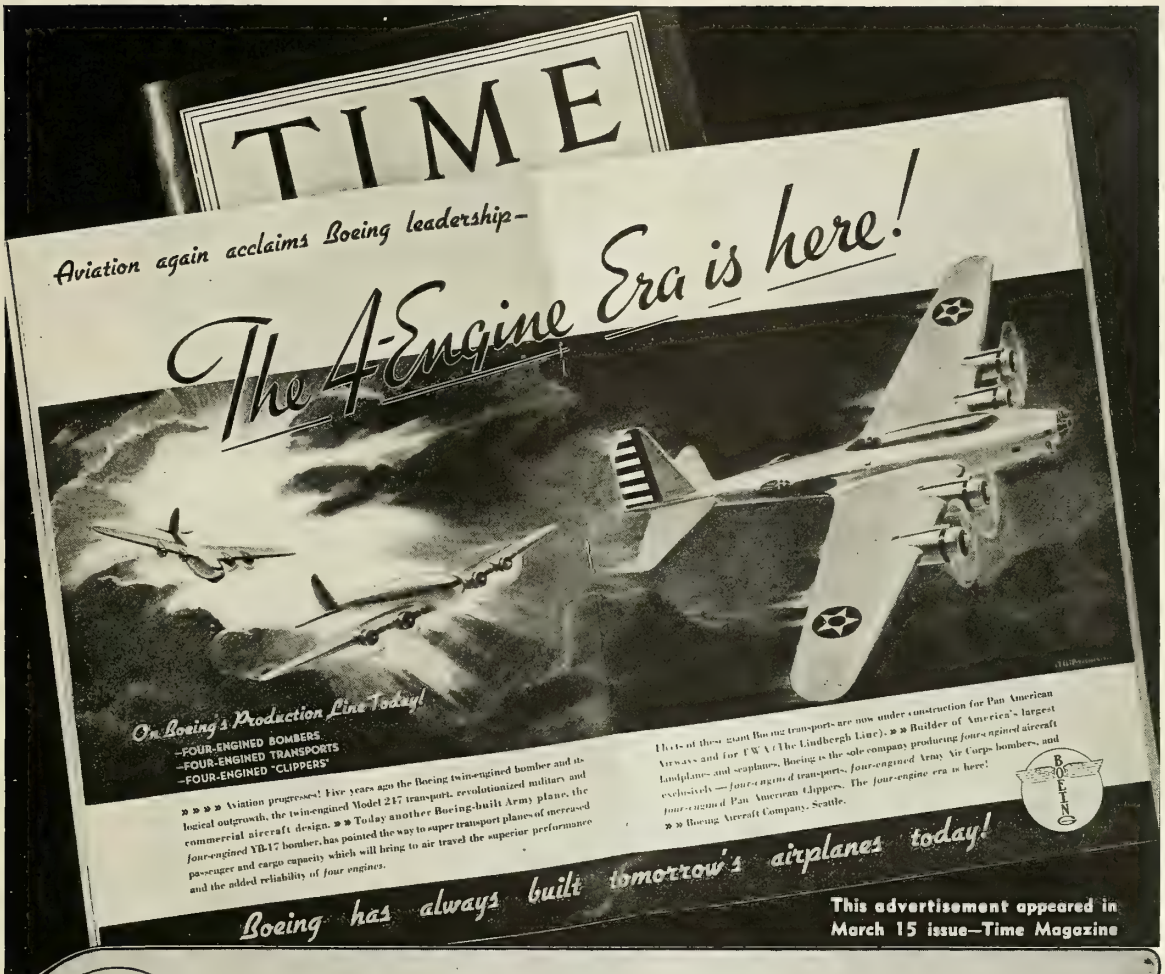


FIG. 2




BOEING

# AVIATION IS PROGRESSING!

IT was only a few years ago that Boeing introduced the Model 247 twin-engined transport—pace-setter of modern commercial aircraft design.

Today, with fleets of four-engined airplanes, commercial as well as military, on the production line, it becomes Boeing's privilege to announce the arrival of aviation's four-engine era—the real significance of which is adequately described in the phrase, *added reliability.*—Boeing Aircraft Company, Seattle.

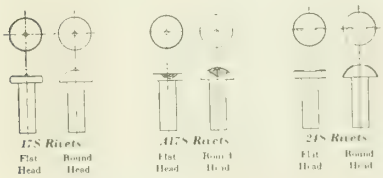
***Boeing has always built tomorrow's airplanes today!***

# RIVETING OF ALUMINUM AND ITS ALLOYS

● Riveting of aircraft is limited to the smaller sizes of rivets and consequently it is nearly always done cold. The most commonly used rivet, 17S driven immediately after quenching, develops an ultimate shear strength, based on the area of the hole, of 35,000 lbs./in.$^2$ about four days after being driven.

Where a shear strength higher than that of 17S is needed, 24S rivets are sometimes used. Driven immediately after quenching from a temperature of 910°F. to 930°F., they develop within about one day an ultimate shear strength of about 44,000 lbs./in.$^2$ based on the area of the hole. Since the rate of age-hardening of 24S rivets is more rapid than that of 17S rivets, it is necessary to drive them more quickly after quenching; the elapsed time should not exceed 20 minutes. Rivets of 24S are more difficult to drive than those of 17S. They are not regularly carried in stock and may not always be obtained as promptly as rivets in the other alloys.

The rate of aging of both alloys can be greatly retarded by storing the freshly




*Identification marking on rivet beads*

quenched rivets at low temperatures. At 32° F. they may be kept in a workable condition for about twenty-four hours after quenching, and lower temperatures will increase this period. Immediately after being removed from low temperature storage, rivets of both alloys age harden at the normal rate.

Rivets of both alloys are often stocked in the fully heat-treated or T condition in order to preclude the possibility of unheat-treated rivets being processed into an aircraft structure. Workmen failing to reheat treat such a heat-treated rivet in either of these alloys will have difficulty in heading it up, which will remind him that the rivet should be heat-treated in order to render it more workable. Under similar circumstances and with a rivet which had not already been heat-treated, he might unwittingly leave the relatively soft rivets in place to the detriment of the finished structure.

Rivets of A17S-T, 53S-W or 53S-T, driven in the as-received condition, are being used more and more in aircraft

**TABLE I: SHEAR STRENGTHS AND SAFE SHEAR DESIGN STRESSES FOR DRIVEN RIVETS**

| Rivet | Average Ultimate Shear Strength Lb. per square inch | Recommended Safe Shear Design Stress,* Lb. per square inch |
|---|---|---|
| A17S-T | 30,000 | 8,500 |
| 17S** | 33,000 | 10,000 |
| 53S-W | 25,000 | 7,000 |
| 53S-T | 28,000 | 8,000 |
| 17S** | 34,000 | 9,000 |
| 53S** | 20,000 | 6,000 |

* These values have a factor of safety of about 3.5. ** Immediately after driving the shear strengths of these rivets are about 75% of the values shown. On standing at ordinary temperatures they age harden to develop their full strengths, this action being completed in about four days.

construction to avoid shop heat treating, refrigeration and similar operations involved in the use of 17S and 24S rivets. These rivets develop ultimate shear strengths somewhat less than that of 17S (Table I) but are quite satisfactory for many purposes. They drive as readily as 17S rivets and can be driven much more easily than 24S rivets.

When bare Alclad 17S-T or Alclad 24S-7 sheet is used, 53S-W or 53S-T rivets are the most satisfactory because they have the best inherent resistance to corrosion of any of the foregoing rivets, and in addition, they have substantially the same electrolytic potential as the Alclad coating. Under severely corrosive conditions, the heads of A17S, 17S and 24S rivets tend to be protected electrolytically by the Alclad coating. Rivets of 53S-W and 53S-T do not show this tendency and hence their use insures longer life to the coating in the vicinity of the rivet.

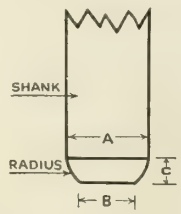
Identification markings have been adopted for use on the heads of aircraft rivets of the following alloys: 17S, A17S and 24S. No identification marks have yet been adopted for rivets of the other alloys.

Certain sizes of aluminum alloy rivets can now be supplied with the shank ends chamfered thus simplifying insertion of

A = Shank Diameter
B = Diameter of End
C = Length of Radius

*Formulas*
C = .25 × A
Radius = .3125 × A

| Diameter of Rivet Inches | B Inches |
|---|---|
| 1/16 | .047 |
| 5/64 | .071 |
| 3/32 | .094 |
| 7/64 | .118 |
| 1/8 | .141 |
| 9/64 | .165 |




*Sketch showing chamfered shank ends*

the rivet into the hole, particularly with automatic riveting machines.

In a properly designed riveted joint, rivet sizes and spacings are selected so that the force acting on any individual rivet does not exceed the safe design value of the rivet. Safe design values are given in shear, tension and bearing (crushing), and are determined so that an ample margin of safety is provided against each of the three corresponding types of failure.

The first consideration in the selection of the proper rivet is its shear value. This depends upon: (1) its cross-sectional area; (2) the shear strength of the material; and (3) the number of planes along which the rivet tends to shear; viz., single shear, double shear.

The cross-sectional area of a driven rivet is an uncertain quantity because hole sizes vary. In addition, the size of the hole is generally increased by the swelling of the rivet when it is upset. Some engineers use the nominal diameter of the rivet for calculating areas and others use the diameter of the hole. In most cases, it seems unnecessarily conservative to base calculations on the nominal diameter of the rivet; therefore, it is recommended that the hole diameter be used up to a limiting value 5% greater than the nominal diameter of the rivet.

In general, the nominal shear strength of the rivet material is a good basis for calculating the shear strength of driven rivets. Actual tests on driven rivets have indicated that in some cases the driving operation increases the shear strength. Advantage has been taken of this fact in Table I.

The number of planes on which a rivet tends to shear depends entirely on the design of the joint. In most cases, rivets are used either in single or double shear, but occasionally they may be used in triple or even quadruple shear. The shear value of a rivet increases directly as the number of planes upon which shear occurs, so that in double shear a rivet is twice as strong as in single shear.

Table II gives safe design values for various rivets in single shear. These values have been calculated on the basis of a hole diameter 5% greater than the nominal rivet diameter using safe design stresses taken from Table I.

Rivets are not well suited for transmitting loads in tension because a slight eccentricity of load exerts a prying action on the head which may result in early failure. This tendency is especially marked under the condition of repeated loads. Consequently, it is a generally

accepted practice to avoid the use of any connection designed principally for transmitting loads by tension in the rivets. Tensile stresses in rivets cannot always be avoided because the racking of the framework and other secondary effects may produce appreciable tensile loads. In such cases, the safe tension value of a rivet may be taken as one-half the safe single shear value. (See Tables I and II.) Effort should be made to keep such secondary tensile stresses in rivets as low as possible.

Bearing value depends upon: (1) the area in bearing; (2) the bearing strength of the metal in the rivet or plate, whichever is the lower; and (3) the edge distance in the direction in which the joint is stressed.

The area in bearing is the thickness of metal times the diameter of hole. It is recommended that for calculating bearing areas the hole diameter be taken not greater than 1.05 times the nominal rivet.

The ultimate bearing strength of aluminum alloys in contact with driven rivets is about 1.8 times the nominal tensile strength of the metal, provided the edge distance in the direction of stressing is equal to at least twice the diameter of the hole, the edge distance being measured from the center of the hole. For smaller edge distances, the bearing strength drops off about in proportion to the decrease in edge distance, so that for an edge distance of one and one-half diameters the bearing strength is about three-quarters of that for an edge distance of two diameters.

Bearing tests of joints show that the first appreciable permanent distortion of the hole occurs when the bearing stress is approximately equal to the nominal tensile strength of the material and that this yielding is practically independent of the edge distance.

For use in joining Alclad materials and 52S or 53S alloys, regard should be given to 53S rivets in a temper which will provide mechanical properties consistent with the stresses to be anticipated (53S "as forward" rivets normally are not used for strength joints). The reason for this is based on the fact that the electrolytic solution potentials of high purity aluminum, 52S and 53S are substantially equal. This fact eliminates the possibility of disfiguring dissolution of metal adjacent to the rivet heads as a result of electrolytic action. Such action may not be structurally destructive and

**TABLE III: SAFE BEARING DESIGN STRESSES FOR DRIVEN RIVETS**

| Rivet | Driving Procedure | Safe Bearing Design Stress, Lb. per square inch |
|---|---|---|
| A17S-T | Cold, As-received | 19,000 |
| 17S | Cold, immediately after quenching | 26,000 |
| 53S-W | Cold, As-received | 14,000 |
| 53S-T | Cold, As-received | 18,000 |
| 17S | Hot, 930° to 950°F. | 26,000 |
| 53S | Hot, 960° to 980°F. | 14,000 |

**TABLE II: SAFE DESIGN VALUE OF ONE RIVET IN SINGLE SHEAR, LB.**

| Size, inches | Cold Driven | | | | Hot Driven | |
|---|---|---|---|---|---|---|
| | A17S-T | 17S* | 53S-W | 53S-T | 17S | 53S |
| 1/4 | 460 | 540 | 380 | 430 | — | — |
| 5/16 | — | 1,220 | 850 | 980 | 1,100 | 730 |
| 3/8 | — | 2,160 | 1,510 | 1,730 | 1,940 | 1,300 |
| 5/8 | — | 3,380 | 2,370 | 2,710 | 3,040 | 2,030 |
| 3/4 | — | — | 3,410 | — | 4,370 | 2,920 |
| 7/8 | — | — | — | — | 5,950 | 3,980 |
| 1 | — | — | — | — | 7,790 | 5,190 |

*Driven immediately after quenching.

in the case of A17S-T, 17S-T and 24S-T rivets, when used to join Alclad materials, is actually an indication of the protective action of the high purity coating adjacent to the rivet heads. However, for reasons of appearance, especially under severe salt water conditions, it is desirable to avoid this action. Bearing this in mind, 53S rivets may prove more desirable for use with Alclad sheet than rivets of A17S-T, 17S-T or 24S-T.

In some cases it may be necessary to join 17S-T or 24S-T stringers, stiffeners, or other structural members of Alclad materials. However, since it is the normal practice to paint such members prior to assembly and since such members are normally installed on the inside of aircraft structures, it is not likely that significantly serious results are to be anticipated.

The resistance to corrosion of 53S alloy is, of itself, superior to that of A17S-T, 17S-T or 24S-T, and the alloy is highly resistant to normal atmospheric and salt water influence.

The first requirement of riveted joints is that they be strong enough to transfer safely the forces acting on the parts joined. This requirement is responsible only in a general way for the design of the joint, because a number of joints can be designed for any given case, all strong enough, but varying widely in size and spacing of rivets. In the following paragraphs, the factors influencing the proportions of riveted joints are discussed. Such factors will be found helpful in laying out highly stressed joints, as well as those in which the rivets are used simply to fasten two or more parts together.

If a large rivet is used in thin metal, the bearing strength usually governs and there is an excess of shear strength. Moreover, the pressure required to drive the large rivet frequently causes an undesirable bulging of the thin material around the rivet head. For these reasons, the diameter of the rivet should rarely exceed 2.5 to 3 times the thickness of the sheet or plate.

On the other hand, if a small rivet is used in a thick plate, the shear strength is the determining factor and there is an excess of bearing strength. Small holes in thick plate usually make fabrication difficult. Experience indicates that the rivet diameter should be not less than the thickness of the thickest plate through which it is driven.

Spacing of rivets in any joint ordinarily depends upon the proportions of the members joined. The minimum spacing is determined by driving conditions—the space between the rivets must be sufficient to permit them to be driven without interference. Three times the nominal rivet diameter is the recommended minimum spacing. In tension members and joints, the spacing must be such that the net stressed area is not too small, and in some cases this becomes the controlling consideration.

Maximum spacing of rivets in compression members may be governed by the possibility of the buckling of the component parts between rivets. In other types of members, the maximum spacing is determined usually by the designer's sense of proportion, especially, when the rivets are used simply to hold two or more plates or shapes together. As a general rule, it is recommended that the maximum distance be not greater than 24 times the thickness of the sheet or plate.

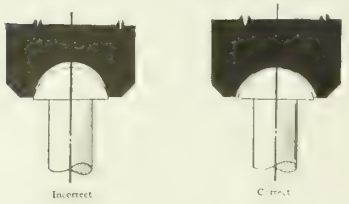
For maximum bearing strength, the edge distance measured from the center of the hole in the direction of stressing should be at least twice the diameter of the rivet hole and that the allowable bearing stress is decreased if the edge distance is less than this. Aside from considerations of strength, the edge distance is important because of the possibility of bulging the edge of the plate, thus causing an unsightly finished joint. Such bulging may be avoided by maintaining an edge distance of at least 1.5 times the diameter of the rivet and being careful to avoid overdriven rivets. When edge distances less than 1.5 diameters are used, the rivets generally must be underdriven to avoid bulging the plate.

Riveted joints which must be pressure-tight may be caulked either by deforming the edges of the plates with a caulking tool or by using caulking strips of a softer alloy to seal the joint. Joints which are to be caulked in this manner should have edge distances about 1.5 times the rivet diameter or about 4 times the thickness of plate. The spacing of rivets should not exceed 4 times the rivet diameter nor about 10 times the thickness of plate. The rivets ordinarily should be stressed about 20% less in bearing and shear than is indicated in the accompanying tables.

In some types of riveted joints where it is not convenient to caulk in the way described, the joint often can be made pressure-tight by packing it with a material to act as a seal. It is important that such a material be non-absorbent, firm enough so it will not "bleed" through the joint, and over a period of time, tough enough not to crack or spall. Such packing materials should be noncorrosive to aluminum and should be applied in layers thin enough not to appreciably affect the strength of the joint.

Squeeze riveters generally are preferable to other types for driving rivets in aluminum. Their use assures properly upset shanks and well-centered heads.

Aluminum alloy rivets may be headed by a heavy hand hammer or sledge. This method has been found satisfactory for work which permits adequate bucking.



*Correct and incorrect fit of the bucking tool on the manufactured head*

Rivet sets for use on aluminum alloy rivets should have smooth, polished surfaces so that the metal may flow readily during the forming of the head. The bucking tools, especially those used with the larger hammers, should have plenty of mass distributed close to the rivet head, and be concentric with it. The cup on the bucking-up set should be slightly wider and shallower than the manufactured head so that the initial contact will be at the end of the head directly in line with the shank to prevent the shank from being driven up into the head, and facilitate uniform upsetting throughout the length of the shank.

For heat treating aluminum alloy rivets, a reliable temperature indicator is essential in order to insure the required temperature control. When rivets are to be quenched in water for cold driving, the heating equipment generally consists of a bath of sodium nitrate heated by gas, oil or electricity. The rivets are handled in a basket made of wire mesh or perforated sheet and must be quenched quickly after removal from the heating bath. All nitrate must be washed off.

It is often desirable to avoid having the rivets directly in contact with the nitrate, and tanks for heat treating rivets are often equipped with steel tubes, closed at one end and immersed in the nitrate with the open end projecting slightly and fitted with a readily removable cap. The rivets are heated by placing them inside these protecting tubes for about 30 minutes. At the end of this period, the cap is removed, the tube quickly withdrawn from the bath and the rivets immediately poured into the quench water. Electrically-heated air furnaces also may be used to avoid having the rivets in nitrate, but care should be taken in such furnaces to have the temperature uniform throughout.

Aluminum alloy rivets for hot driving are commonly heated in a lead pot or in an electrically-heated air furnace. Automatic control of temperature is highly desirable in both types. The heating equipment must be near the work so that the temperature lost in transfer is minimized. When heating in a lead bath, provision must be made to submerge the rivets in the bath, otherwise they will float. All adhering lead should be removed by a sharp blow against some solid object, before the rivet is inserted in the hole.

Rivet holes in aluminum alloys may be punched, drilled, or sub-punched and reamed to size, the last being preferable, especially if done in assembly to give the holes exact coincidence. It has been found that bridge reamers of the spiral-fluted type are best suited for use in aluminum and aluminum alloys.

The clearance which is to be allowed in the holes depends largely on the class of work. It is easier to drive rivets (especially those cold driven) when the clearance is small. If a loose fit is used, it will be difficult to hold the rivets straight, and eccentric heads often result. The best clearance is the smallest one which will allow the rivet to be inserted easily without delay. Hot rivets require more clearance than cold ones because it is harder to handle them.

Rivet holes tend to get out of coincidence during the driving operation because of slippage, swelling of the metal, and warping caused by heat. For this reason, the work should be assembled firmly by bolts before driving. The bolting should be tight to prevent slippage and to prevent the rivets from squeezing out between the parts of the joint.

The length of rivet required for forming a head depends upon the grip or total thickness of metal through which the rivet is driven, clearance between rivet and rivet hole, the alloy, and the form of head. Because of variations in rivet sets and driving conditions, the safest method to follow is to make several trials with the equipment to be used on the job before specifying the exact length of rivets. It is better to have the rivets slightly too long rather than too short, because a short rivet may allow the rivet set to strike and damage the plate.

## THE CURTISS WIND TUNNEL

(*Continued from page 29*)

operating table. Rigidly supported to the table is the fairing structure, revolving with the table in yaw.

The pitching moment system offers some convenient features. The quadrant shown has one fulcrum on the centerline of the main balance carriage and the other supported directly by the pitch balance. All forces acting on the quadrant therefore act with a constant moment arm and register the moment about the centerline of the carriage. Straddling this quadrant and rotating about the centerline of the carriage also is the pitch arm which is connected to the model by the pitch rod, thus making a parallelogram system. Forces are transmitted from the pitch arm to the quadrant through a pinion and rack. The pinion, operated by a reversible electric motor controlled from the operating table, moves along the rack in changing the angle of attack. A standard rounds counter, geared to the pinion to give readings of angle of attack directly, is mounted on the pitch arm in such a location that it is easily read by the operator at all angles.

Some compromise had to be reached in arranging the balances for measuring the forces on the carriage. Four balances, including the pitch balance, measure lift. The difference in the two side lift balances gives the rolling moment. Side force and yawing moment are measured by a separate balance, and drag can be measured by two balances—a separate balance resisting down stream movement of the complete carriage or by the upstream lift balance as a moment. In operation, the separate drag balance is found to be unnecessary and the lift balance is used instead.

From an operation standpoint, the present wind tunnel equipment offers what might be termed a one-man tunnel in which the convenience of operation is obvious. The small box on the right of the operator's table houses the toggle switches for the velocity control in the tunnel, the angle of attack control and the switch for stopping the balance motors simultaneously. To his left is the manometer and the control for yawing the model and balances. Each balance counter is directly on eye-level and is enlarged with a shaded magnifying glass so that readings are easily visible from the seat, as are the angle of attack counter and the yaw angle scales. Aside from two or three pan weight changes the operator can run a complete six-component test on a model including yawing moments at various angles of yaw, without leaving the table.

### General

In addition to routine force tests on models, special testing is done as the necessity arises. Stalling characteristics of wings and complete models are investigated by studying the lift curve peak in connection with short silk thread tufts put on the model with strips of cellophane tape, a method by which the airflow can readily be studied without altering the flow, and which has replaced the use of smoke, hot wire grid, pitot comb and various streamers. Two dimensional flow has been studied with lampblack

(*Continued on page* 100)



# AIR TRAVEL "TO ALL COUNTRIES" *in 1843*

NEARLY a century ago, an optimistic English engineer named William Samuel Henson attempted to organize the "Aerial Transit Company" for regular air travel "to all countries." The vehicle to be used by this "gigantic enterprise" was the Henson Aerial Steam Carriage pictured above—the first airplane design to propose the monoplane.

Henson planned to use a 25 to 30 horsepower steam engine to furnish the power, actually completed a lightweight 10 horsepower steam engine to fly a model one-seventh the size of his proposed big air liner. Not one of Henson's models ever got off the ground, largely because of a woeful deficiency in his power-weight ratio.

Only with gasoline and the gasoline engine did heavier-than-air craft become a practical reality. Constant progress in engine horsepower and power-weight ratio has demanded constant progress in fuel characteristics. Today, Ethyl Aviation Gasoline is keeping pace with present demands, and Ethyl engineers are cooperating in further progress. Ethyl Gasoline Corporation, Chrysler Building, New York, N. Y.

# Simplified Method of Beam Analogy

ERVIN H. WATTS

● Structural aeronautical engineers are more familiar with Prof. Hardy Cross' method of moment distribution than with his column analogy method by which continuous frames, such as bulkhead rings, can be comparatively easily solved. By this analogy problems of this nature are reduced to the familiar flexure equations of $P/A + My/I$.

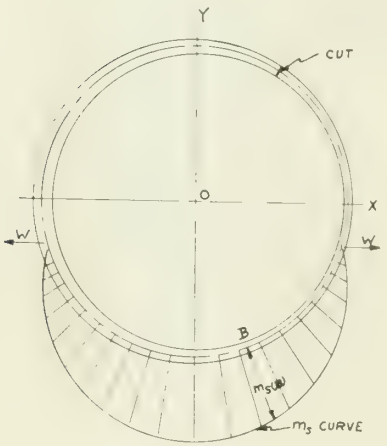



Fig. 1a. Ring with applied load

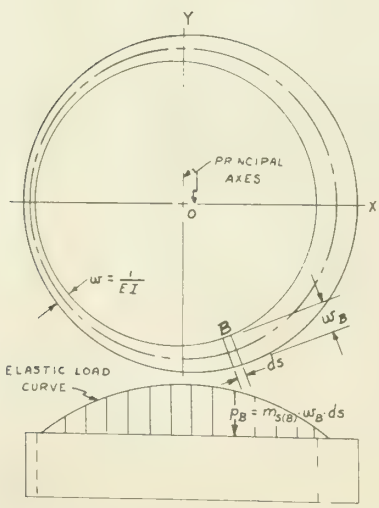



Fig. 1b. Analogous column

### The Analogy

1—Replace the ring with a short length of column, a section of which has the same shape as the ring and a small width varying along the sides as $1/EI$ of the section. Determine the area, principal axes, and principal moments of inertia of this column (figures 1a and 1b).

2—Consider the ring cut at any point and determine the moments at all points of the ring due the applied loads. Multiply these moments by the elastic areas at the same points. The result is the elastic loading on the analogous column. Thus in figure 1a, if the moment due to the applied loads with the ring cut is $m_s$ at point B, the corresponding elastic load $p$ at this point is $m_s w\ ds$ (where $w = 1/EI$ at this section) as shown in figure 1b.

3—Then the moment at any point on the ring due to the restraining forces at the cut section equals $P/A + M_x\ x/I_x + M_y\ y/I_y$ where $P$ equals the summation of the above mentioned elastic loads, $M_x$ and $M_y$ are the moments of these loads about the principal axes of the analogous column, and $A$, $I_x$, and $I_y$ are section properties of the analogous column.

4—The combined moment at any point equals the difference between $m_s$ due to the applied forces and $m_1$ due to the restraining forces at the cut section.

### Nomenclature

A—Area of analogous column.
$I_x$—Moment of Inertia about O-Y.
$I_y$—Moment of Inertia about O-X.

### Convention of Signs

In figures 1a and 1b, the statically determinate moments $m_s$ are positive when they tend to open the ring; elastic loads due to positive values of $m_s$ are positive; and values of $x$ and $y$ in the upper quadrant are positive.

A derivation of the above analogy is included as an appendix to this article and some examples follow.

*Example A:* Elastic width of AB = 1/2.599 = .385. The elastic width of the other sides are determined similarly. Then

$A = 27.58\ (.385 + .370) + 2 \times 27.59 \times .427$
$= 10.60 + 10.20 + 23.58$
$= 44.38$

N.A. $= 13.80\ (10.60 - 10.20)/44.38$
$= .124''$ above

$I_y = (1/12) \times 23.58\ (27.59)^2 + 20.80\ (13.80)^2 - 44.38\ (.124)^2$
$= 1492 + 3960$
$= 5452$

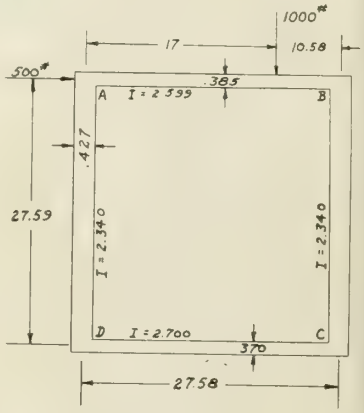
$I_x = (1/12) \times 20.80\ (27.58)^2 + 23.58\ (13.79)^2$
$= 1315 + 4470$
$= 5785$

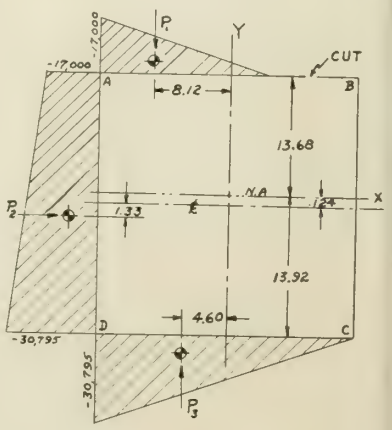
$P_1 = -[(17{,}000)\ (17)\ (.385)/2] = -55{,}600$

$P_2 = -[(17{,}000 + 30{,}795)/2]\ 11.79 = -282{,}000$

$P_3 = -[(30{,}795/2)]\ 10.20 = -157{,}000$

Total $P = -494{,}600$



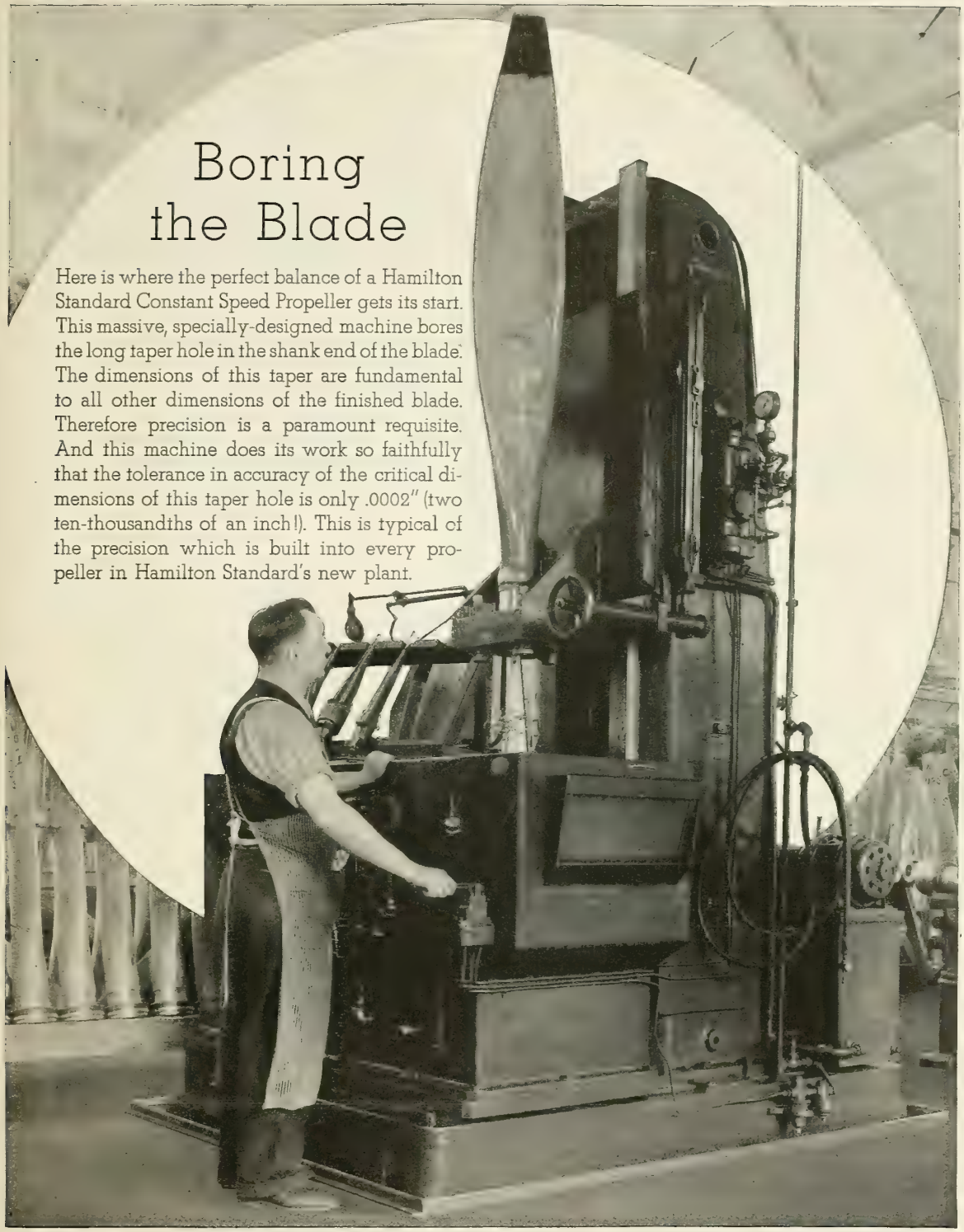




*Example A*

$M_y = -(55{,}600 \times 13.68) + (282{,}000 \times 1.454) + (157{,}000 \times 13.92)$
$= -760{,}000 + 410{,}000 + 2{,}186{,}000$
$= 1{,}836{,}000$

$M_x = (55{,}600 \times 8.12) + (282{,}000 \times 13.79) + (157{,}000 \times 4.60)$

(*Continued on following page*)



# Boring the Blade

Here is where the perfect balance of a Hamilton Standard Constant Speed Propeller gets its start. This massive, specially-designed machine bores the long taper hole in the shank end of the blade. The dimensions of this taper are fundamental to all other dimensions of the finished blade. Therefore precision is a paramount requisite. And this machine does its work so faithfully that the tolerance in accuracy of the critical dimensions of this taper hole is only .0002" (two ten-thousandths of an inch!). This is typical of the precision which is built into every propeller in Hamilton Standard's new plant.

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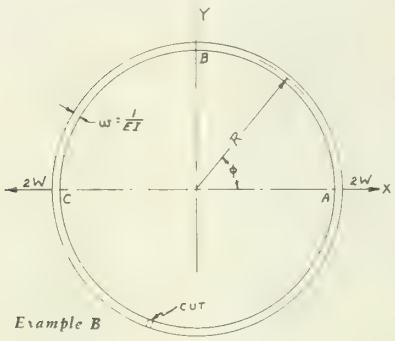
**DIVISION OF UNITED AIRCRAFT CORPORATION • • • EAST HARTFORD, CONN.**

*(Continued from preceding page)*

$= 452{,}000 + 3{,}880{,}000 + 722{,}000$
$= 5{,}054{,}000$

$m_1$ at A
$= -494{,}600/44.38 + [(1{,}836{,}000)(13.68)/5452] - [(5{,}054{,}000)(13.79)/5785]$
$= -11{,}150 + 4600 - 12{,}050$
$= -18{,}600$
$m_A = m_s - m_1 = -17{,}000 + 18{,}600 = 1600$
$m_{1(B)} = -11{,}150 + 4600 + 12{,}050 = 5500$ and $m_B = -5500$
$m_{1(C)} = -11{,}150 - 4700 + 12{,}050 = -3800$ and $m_{(C)} = 3800$
$m_{1(D)} = -11{,}150 - 4700 - 12{,}050 = -27{,}900$ and $m_{(D)} = -30{,}795 + 27{,}900 = -2895$

*Example B:* $A = 2\pi R/EI$, $I_x = I_y = \pi R^3/EI$
$m_s = 2WR\sin\phi$
$\rho_s = 2WR^3 \sin\phi\, d\phi/EI$

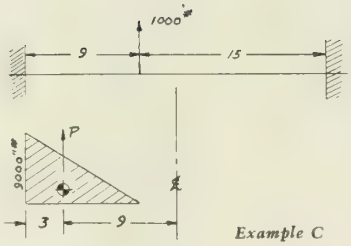



*Example B*

$$F = (2WR^2)\ EI \int_0^{\pi} \sin\phi\, d\phi$$
$$= (2WR^2/EI)\left[ -\cos\phi \right]_0^{\pi} = 4WR^2/EI$$
$$M_y = \int_0^{\pi} 2WR^3 \sin^2\phi\, d\phi\ /EI$$
$$= (2WR^3/EI)\left[ (\phi/2) - (1/4) \sin 2\phi \right]_0^{\pi} = \pi WR^3/EI$$

$M_x = 0$
$m_{1(A)} = 4WR/2\pi R = (2/\pi)WR$ and $M_A = -(2/\pi)WR$
$m_{1(B)} = (2/\pi)WR + (\pi WR^3 R/\pi R^3) = WR[(2/\pi) + 1]$ and $M_B = 2WR - WR[(2/\pi) + 1] = WR[1 - (2/\pi)]$
$m_{1(C)} = (2/\pi)WR + WR\sin\phi = WR[(2/\pi) + \sin\phi]$ and $M_{(C)} = WR[\sin\phi - (2/\pi)]$

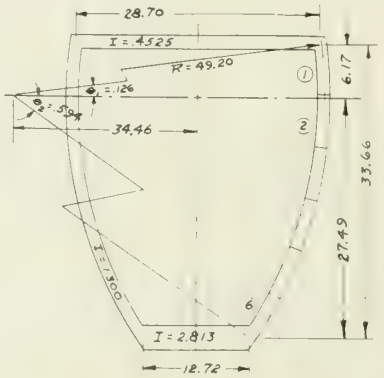
*Example C:* This method can be usefully extended to beams fixed at the ends. The ring is then completed by the foundations and is of infinite moment of inertia or zero elastic area. Consider the example illustrated here in which with uniform $I$ the elastic width can be considered as 1.0. The ring will be considered cut between C and B.

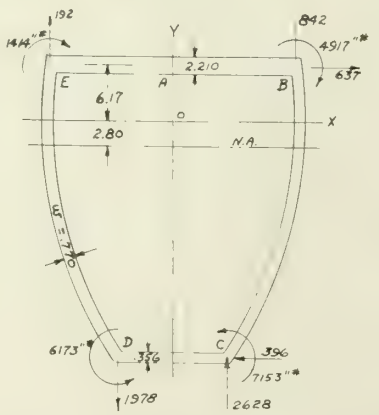



*Example C*

$A = 24.0$ $\quad I/y = 24^3/6 = 96$
$P = .5 \times 9 \times 9000 = 40{,}500$
$m_{1(A)} = (40{,}500/24) + [(40{,}500)(9)/96]$
$= 1690 + 3800$
$= 5490$, and $M_A = 9000 - 5490 = 3510$
$m_{1(B)} = 1690 - 3800$
$= -2100$, and $M_B = 2110$

*Example D:* An application of this method is the analysis of frames of curved sides, varying moments of inertia, unsymmetrical loading, or other complicated analyses. The computations required of course are somewhat lengthier than for




| No. | θ | sin θ | cos θ | 49.20 cos θ | x = (4) − 34.46 | y = 49.20 sin θ | $x^2$ | $y^2$ |
|---|---|---|---|---|---|---|---|---|
| 1 | .066 | .0660 | .9978 | 49.09 | -14.63 | 3.25 | 214.0 | 10.5 |
| 2 | -.054 | -.0540 | .9985 | 49.13 | -14.67 | -2.66 | 215.0 | 7.1 |
| 3 | -.174 | -.1732 | .9849 | 48.46 | -14.00 | -8.52 | 196.0 | 72.5 |
| 4 | -.294 | -.2900 | .9570 | 47.08 | -12.62 | -14.27 | 159.4 | 203.0 |
| 5 | -.414 | -.4027 | .9155 | 45.04 | -10.58 | -19.79 | 111.5 | 392.0 |
| 6 | -.534 | -.5090 | .8607 | 42.35 | -7.89 | -25.04 | 62.0 | 627.5 |
| | | | | | | | -67.03 | 357.9 1312.6 |

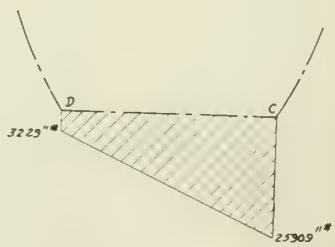
a frame of straight sides. However, all calculations are simple in nature and as illustrated by the following example, are easily followed.

$dA$ (#1 to #6) $= 49.20 \times .120 \times .770 = 4.55$
$A = 28.70 \times 2.210 + 12.72 \times .356 + 12 \times 4.55$
$= 63.5 + 4.53 + 54.5$
$= 122.53$
N.A. $= [(2)(4.55)(67.03) - (63.5)(6.17 + 4.53)(27.49)]/122.53$
$= 610 - 392 + 125/122.53$
$= 2.80''$ below O-X
$I_{y(NA)} = 2 \times 4.55 \times 1312.6 + 392 \times 6.17 + 125 \times 27.49 - 122.53 \times 2.80^2$
$= 11950 + 2420 + 3430 - 960 = 16840$
$I_x = 2 \times 4.55 \times 957.9 + 1/12 \times 2.210 \times 28.70^3 + 1/12 \times .356 \times 12.72^3$
$= 8720 + 4325 + 60$
$= 13105$

Assume that the ring is cut at point A, then

$m_{s(D)} = -192 \times 7.99 - 1414 + 6173$
$= -1530 - 1414 + 6173$
$= 3229$
$m_{s(C)} = 842 \times 7.99 + 4917 - 7153 + 637 \times 33.66$
$= 6725 + 4917 - 7153 + 21420$
$= 25909$

Elastic Loads and Moments for D-C

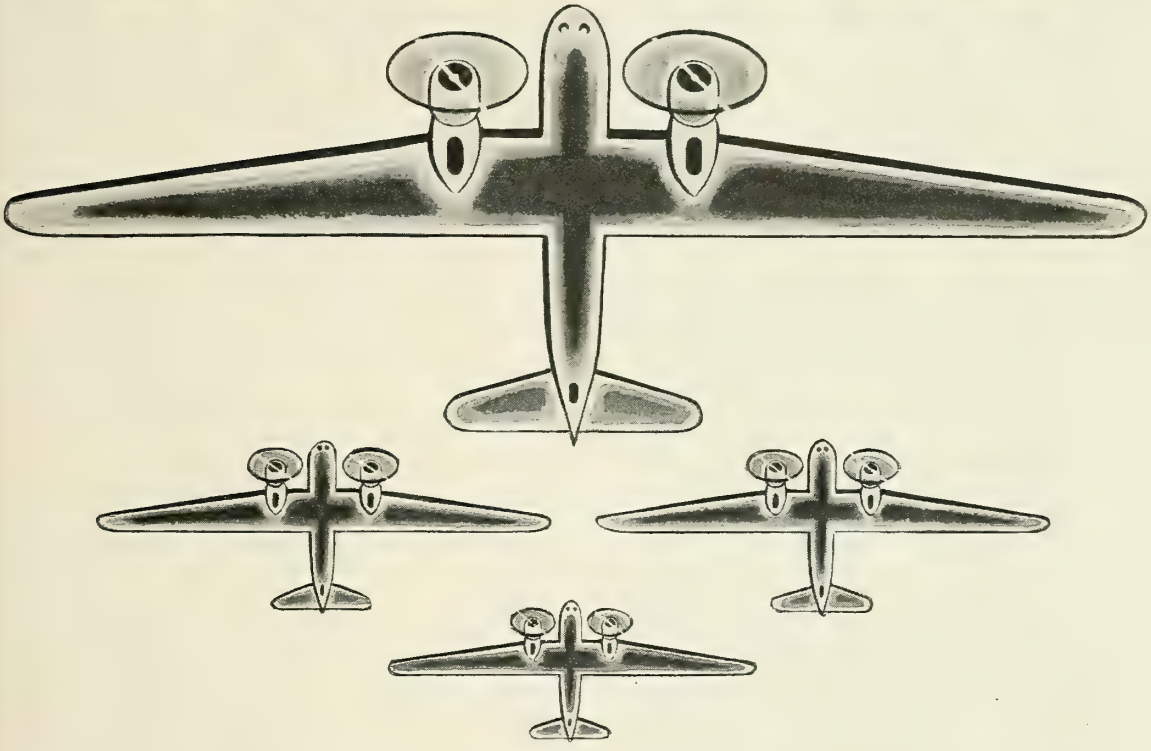



$P = .5 \times 4.53 \times (3229 + 25909)$
$= 7325 + 58750$
$= 66075$
$M_y = -66075 \times 27.49$
$= -1{,}819{,}000$

*(Continued on following page)*

| NO. | Elastic Load, P (1) x | (2) y | (3) x+14.35 | (4) -192 x(3) | (5) (4)-1414 | (6) 4.55 x(5) | $M_y$ (7) (2)x(6) | $M_x$ (8) (1)x(6) |
|---|---|---|---|---|---|---|---|---|
| L 1 | -14.63 | 3.25 | -0.28 | 54 | -1360 | -6200 | -20180 | 90700 |
| 2 | -14.67 | -2.66 | -0.32 | 62 | -1352 | -6160 | 16400 | 90500 |
| 3 | -14.00 | -8.52 | 0.35 | -67 | -1481 | -6750 | 57500 | 94500 |
| 4 | -12.62 | -14.27 | 1.73 | -332 | -1736 | -7950 | 113400 | 100400 |
| 5 | -10.58 | -19.79 | 3.77 | -725 | -2139 | -9730 | 192600 | 103000 |
| 6 | -7.89 | -25.04 | 6.46 | -1240 | -2654 | -12090 | 302500 | 95300 |
| | | | | | | -48880 | 662200 | 574400 |

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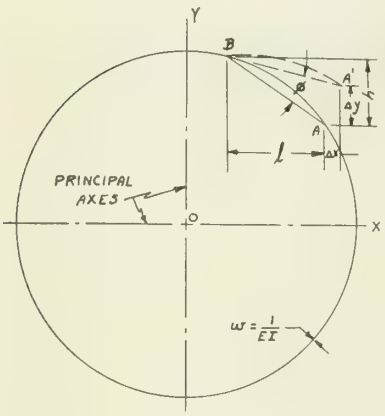
SHELL

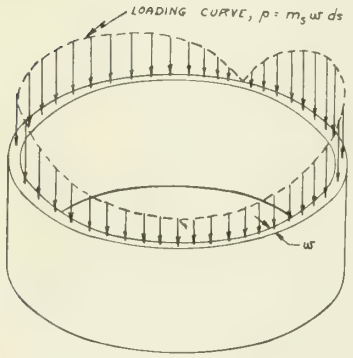
AVIATION GASOLINES

(*Continued from preceding page*)

$M_x = 12.72 \times (58750 - 7325)/6$
$= 109{,}000$
$m_1(_A) = (497945/122.53) - [(7285500)(8.97)/16840] - [(6116400)(14.35)/13105]$
$= 4070 - 3880 - 6770$
$= -6510$, and $m(_A) = 6510$
$m_1(_B) = 4070 - 3880 + 6700$
$= 6890$, and $m(_B) = -6890$
$m_1(_C) = 4070 + [(7285500)(24.69)/16840] + [(6116500)(6.36)/13105]$
$= 4070 + 10690 + 2970$
$= 17730$, and $M = 25909 - 17730$
$= 8179$
$m_1(_D) = 4070 + 10690 - 2970$
$= 11790$, and $m(_D) = 3229 - 11790 = -8561$

**Appendix: Derivation of Column Analogy**




Consider any closed ring as shown here in which O-X and O-Y are the principal axes. Suppose this ring is cut at A and a certain rotation, $\phi$ takes place at B due to the loads applied to the ring.

At A there is now produced (a) a relative rotation of the two sides of the cut $= \phi$; (b) a relative vertical displacement of the two sides of cut $= \phi 1$; and (c) a relative horizontal displacement of the two sides $= \phi h$.

If the ring is continuous, there is actually no relative movement of the two sides of the cut. Distinguish between the rotations that would occur if the ring were cut and those which result from the continuity at A. Call the first $\phi_s$ (rotations due to the forces which are statically determinate) call the latter $\phi_1$ (rotations due to forces which are statically indeterminate). Then if continuity exists

$$\Sigma\phi_s = \Sigma\phi_1, \quad \Sigma\phi_s 1 = \Sigma\phi_1 1, \quad \Sigma\phi_s h = \Sigma\phi_1 h$$

The rotations $\phi_1$ are due to equol and opposite forces on the two sides of the cut section at A. Any moments in the ring due to these forces will be a linear function of $x$, $y$. Call these moments $m_1$ (statically indeterminate moments).

If for $\phi_1$ we write $(m_1 w)\ (ds)$, where $w = \phi_1/(m_1)\ (ds)$, then

$$\int (m_1 w)(ds) = \int (\phi_s)(ds) \quad \ldots\ldots (1)$$
$$\int (m_1 w 1)(ds) = \int (1\phi_s)(ds) \text{ or}$$
$$\int m_1 w (x - x_A) ds = \int (x - x_A)\phi_s\ (ds) \quad \ldots\ldots\ldots\ldots (2)$$

This reduces to $\int (m_1 wx)(ds) = \int (x\phi_s)(ds)$

Likewise $\int (m_1 wy)(ds) = \int (y\phi_s)(ds) \quad \ldots\ldots\ldots\ldots\ldots\ldots (3)$

As noted before, $m_1$ is a linear function of $x$, $y$. The values are assumed to be known constants.

We may write $m_1 = a + bx + cy$ where $a$, $b$, and $c$ are unknown coefficients to be determined from the three relations of continuity just given.

Then $\int (m_1 w)(ds) = a\int (w)(ds) + b\int (wx)(ds) + c\int (wy)(ds) = \int \phi_s\, ds$

Since the axes are taken through the centroid, $\int (wx)(ds)$ and $\int (wy)(ds) = 0$.

Therefore $a = \int (\phi_s)(ds)/\int (w)(ds)$.

Also $\int (m_1 wx)(ds) = a\int (wx)(ds) + b\int (wx^2)\ (ds) + c\int (wxy)\ (ds) = \int (x\phi_s)(ds)$

Since the axes are principle axes, $\int (wxy)(ds) = 0$

Therefore, $b\int (wx^2)\ (ds) = \int (x\phi)\ (ds)$ $(so)$ $(b) = \int (x\phi_s)\ (ds)/\int (wx^2)\ (ds)$

Likewise, $c = \int (y\phi_s)(ds)/\int (wy^2)(ds)$

If we conceive a narrow strip along the perimeter of the ring having a variable width $w = \phi_1/(m_1)\ (ds)$, then $(w)\ (ds)$ corresponds to a differential area. If we treat such a strip around the entire ring perimeter as an area A, we may conveniently write

$$\int (w)(ds_Q = A \qquad \int (wx^2)(ds) = I_x \int (wy^2)(ds) = I_y$$

Similarly $(\phi_s)\ (ds)$ corresponds to a load. If we call the known rotations (due to the applied loads with the ring cut) along the ring perimeter elastic loads, we may write

$$\int (\phi_s)(ds) = P \qquad \int (\phi_s x)(ds) = M_x \int (\phi_s y)(ds) - M_y$$

Hence, $m_1 = (P/A) + (M_x\, x/I_x) + (M_y\, y/I_y)$

**The Analogy**

If the effects of flexure only are taken into account, there exists an exact algebraic parallel between the indeterminate moments in an elastic ring and the fiber stresses at the base of a short column.

These are (1) the stiffness $\phi/m$ of each short length of perimeter times the length $ds$ corresponds to a differential area $a$; (2) the indeterminate moments $m_1$ correspond to stress intensities on the column section; and (3) the known angle changes (due to the applied loads on the cut ring) correspond to loads $p$ on the column section.

Take a ring subject to known loads. Consider it cut at some point and draw curves of moments for these loads.

Picture a short length of column as in the above figure, a section of which has the same shape as the ring and a small width varying along the perimeter as the elastic width $w$ where $w = \phi/m\ ds = 1/EI$.

Load this column with a loading equal to the bending moments given by the curve of bending moments just computed times the elastic width at each section. The indeterminate moments will now equal the fiber stress which would exist on cross-sections of this column.

The total moment at any point will equal the moment due to the applied loads with the ring cut minus the indeterminate moments determined above.

| | Elastic Load, P | | | | | | | | $M_y$ | $M_x$ |
|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| No. | x | y | x-14.35 | -842 ×(3) | 6.17 -y | 637 x(5) | (4)+(6) +4917 | 4.55 x(7) | (2)×(8) | (1)×(8) |
| R 1 | 14.63 | 3.25 | 0.28 | -236 | 2.92 | 1860 | 4917 | 29750 | 96700 | 435000 |
| 2 | 14.67 | -2.66 | 0.32 | -270 | 8.83 | 5620 | 10267 | 46700 | -124100 | 685000 |
| 3 | 14.00 | -8.52 | -0.35 | 295 | 14.69 | 9340 | 14552 | 66200 | -563500 | 926000 |
| 4 | 12.62 | -14.27 | -1.73 | 1456 | 20.44 | 13020 | 19393 | 88100 | -1256000 | 1112000 |
| 5 | 10.58 | -19.79 | -3.77 | 3175 | 25.96 | 16520 | 24612 | 112000 | -2218000 | 1185000 |
| 6 | 7.89 | -25.04 | -6.46 | 5445 | 31.21 | 19900 | 30262 | 138000 | -3460000 | 1090000 |
| | | | | | | | | 480750 | -7524900 | 5433000 |
| | | | | | | | | -48880 | 662220 | 574400 |
| | | | | | | | | 66075 | -1819000 | 109000 |
| | | | | | | Total | = | 497945 | -8681680 | 6116400 |
| | | | | | | 497945 x 2.80 = | | | 1396000 | |
| | | | | | | $M_y$ about N.A. = | | | -7285680 | |

# *Hats Off*

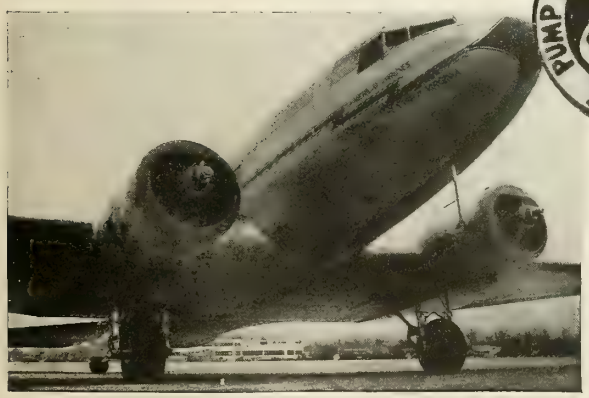
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# Improvements in the Lycoming Engines

● Featuring refinements and improved design details, the new Lycoming "D Series" engines represent the latest development of the Lycoming R-680 nine-cylinder aircraft engine. These engines are rated at 260 hp with a 6.5:1 compression ratio and at 245 hp with a 5.5:1 compression ratio, both ratings being obtained at 2300 rpm at sea level.

Most notable refinement in the new engine is the improved cylinder cooling. Made possible largely by recent advances in foundry technique, longer and more closely-spaced cooling fins provide the D Series cylinder heads with approximately 20 sq. in. of cylinder fin area per cubic inch displacement. This, together with new, closely-fitted cylinder air baffles and rear exhaust ports, permits the new engines to operate at lower temperatures with more uniform cylinder cooling under all operating conditions. Additional cylinder cooling, as well as greater strength, has been secured by the application of ribbed piston design.

Other refinements include use of two valve springs on each exhaust and intake valve to allow operating at higher spring pressures. An improved 13-spline nitralloy accessory drive shaft is driven by a new, removable bushing in the rear of the crankshaft, and the rear spark plug is moved closer to the top of the cylinder, promoting spark plug cooling and improved cylinder combustion.

An improved, piston ring-type impeller oil seal is provided to insure positive sealing of the induction chamber from the oil vapor in the crankcase. This oil seal, replacing the spring-type seal formerly used, consists of a steel sleeve which is clamped by the impeller against the inner race of the rear main bearing. Two split-type rings are assembled in each of three ring-grooves on the circumference of the sleeve. All six rings are compressed inside of a race formed by the extension of the rear bearing sleeve in the crankcase. This new, one-piece bearing sleeve and race lends itself to a rigid construction and, with the six closely-fitted rings, forms a positive oil seal under all operating conditions.

A new oil pressure relief valve assembly incorporates a check valve to eliminate possibility of lubricating oil from the supply tank flowing into the engine when the engine is not operating. The engine oil pump, consisting of one pressure and two scavenging pumps built into a complete unit, now operates at reduced speed. Wear on gears is thereby reduced and adequate oil pressure is available at idling speeds. An oil seal is provided at each distributor to protect the distributor mechanism from the effects of oil vapor in the rear crankcase.

Other new features are the accessory drives and improved equipment. Completely automatic valve gear lubrication is provided by pressure engine oil which is metered through the cam followers and push rods to the rocker arm bearings. The return oil drains through the push rod housings and through external oil lines connecting adjacent rocker boxes to the engine oil sump. New, enclosed rocker boxes are made oil tight by cork gaskets and covers which are secured to each rocker box by four studs and nuts. The one-piece construction of push rod housings, sealed in the rocker boxes with a rubber sleeve and at the crankcase end with rubber hose and hose clamps, prevents oil leakage at these points.

Thorough cleansing of the pressure engine oil is insured by the incorporation of a full-flow Cuno oil filter built-in in the rear crankcase section.

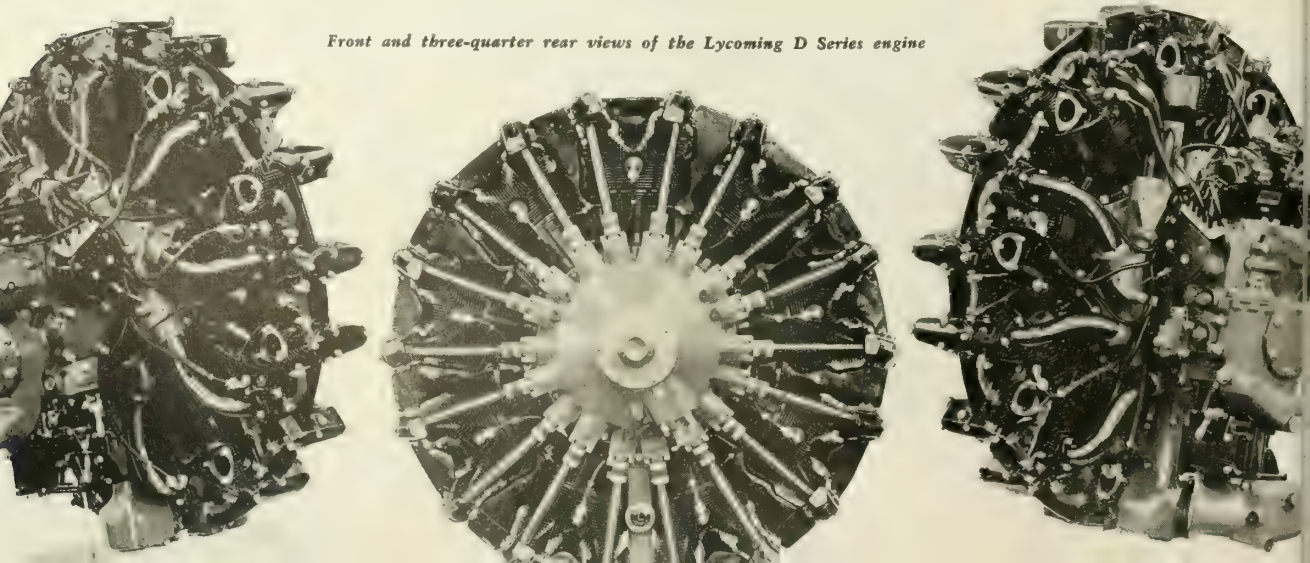
Interchangeability of crankshaft assemblies for both models of the D Series is secured by standardizing the weight of both high and low compression pistons. Standard equipment of Lycoming R-680-D Series engines includes the following accessory drives which are grouped on the rear crankcase section to provide maximum accessibility to accessories; one dual-type magneto (with two independent distributors), starter, generator, fuel pump, vacuum pump for operating navigation instruments, and a tachometer drive connection. Other equipment includes a Stromberg Model NA-R7A single-barrel type carburetor, pressure-type cylinder baffles, a booster coil connection to the left distributor, individual radio shielding, fuel priming connections to top three cylinders, and propeller attaching parts.

The AN Standard #20 splined crankshaft end permits installation of either fixed- or controllable-pitch propellers, including the Lycoming mechanically-operated type or the Hamilton Standard hydraulically-operated type. Provisions for the manual hydro-control mechanism or for the installation of a constant speed governor drive are made within the front crankcase section of each D Series engine.

Specifications for the two models of the Lycoming R-680-D Series are:

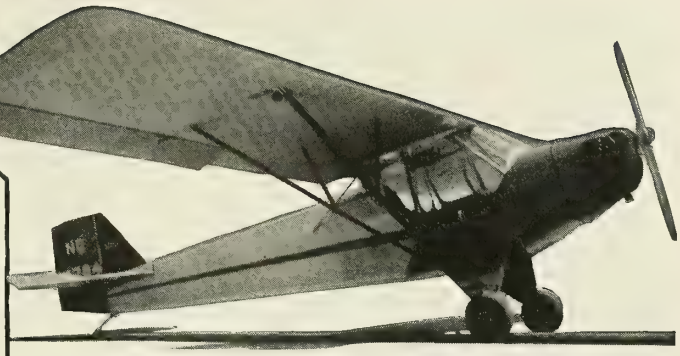
| | | |
|---|---|---|
| Bore | 4.62 | inches |
| Stroke | 4.5 | inches |
| Displacement | 680.4 | cubic inches |
| Overall diameter | 43.5 | inches |
| Overall length | 37.04 | inches |
| Weight (complete) | 516 | pounds |
| Max. fuel consumption (cruising) | 0.52 | lb./bhp/hr. |
| Horsepower (take-off; cont.-pitch prop.) | 245 | 260 |
| Horsepower (normal; fixed prop.) | 225 | 240 |
| Take-off speed (cont.-pitch prop.) | 2300 rpm | 2300 rpm |
| Normal speed (fixed-pitch prop.) | 2100 rpm | 2000 rpm |
| Compression ratio | 5.5:1 | 6.5:1 |
| Octane fuel | 72 | 80 |

*Front and three-quarter rear views of the Lycoming D Series engine*





# THE FIRST TAYLOR "CUBS" WERE GOODRICH EQUIPPED



**BORN IN 1931 AND STILL GOING STRONG**

The second Taylor Cub, built in 1931, and Goodrich-equipped for safety. Called "No. 13" in defiance of superstition, this plane helped 70 flyers to obtain pilot's licenses, including two who were "flying grandfathers" . . . With 3000 flying hours to its credit, the veteran "No. 13" is still faithfully serving its owner.

# . . . AND TAYLOR HAS CHOSEN GOODRICH EVER SINCE!

FROM THE very first days of the Goodrich-equipped Taylor "Cubs," the popularity of this plane has grown by leaps and bounds. Starting with 5 built in 1931, popular demand pushed production of these trim, low-cost ships to 20 a week last year. 550 were sold in 1936 alone and production is still climbing!

And no wonder. Taylor Cubs offer speed, comfort, SAFETY—the safety for example of "sitting down" at 28 miles an hour. And, adding the final element of safety needed by all planes, Taylor equips with Goodrich Low Pressure Silvertowns. Thus Taylor owners have more protection, more smoothness for every landing and take-off.

***Goodrich "Fills the Bill" In Every Aviation Need***

No matter what size planes you build or fly—whether light sport planes or giant transports—Goodrich has tires and over 40 other aviation products that will give you *extra* safety, efficiency and comfort. Remember, when you specify Goodrich you automatically get the benefit of experience in aviation that has caused the leading air lines, pilots and plane makers to equip with Goodrich. See your nearest Goodrich dealer or write to Dept. 630, Aeronautical Division of The B. F. Goodrich Company, Akron, Ohio, for complete information about Goodrich Airplane Silvertowns and other Goodrich Aviation Products.





**TAYLOR CUB—1937 MODEL**

New and improved with many more safety and comfort-giving features, the new Cub is an all-weather, all-year plane. Using only 3 gallons of gasoline per hour and little oil, these planes actually cost less to run than a popular-priced car. And because Cubs are "safety-protected" with Goodrich Airplane Silvertown Tires, landings are safe, sure and smooth.




**THE 1000th CUB . . .** being delivered to Blevins Aircraft Co. of Atlanta, Georgia, during the 1936 Miami Air Races. This scene recalled to mind that during 1931, its first year of manufacture, Taylor sold 5 Cubs. In 1934, 70 Cubs had been sold and in 1935 the number increased to 211. By the end of 1936, 550 cubs had rolled from Taylor production lines to their owners. Since this photograph was taken, sales of the popular Taylor Cubs have shot well past the 1100 mark.




# Goodrich *Airplane* Silvertowns

## THE SAFEST AIRPLANE TIRE EVER BUILT

Over 40 Rubber Products for Airplanes — including Tires — Tail Wheels — Abrasion Shoes — De-Icers — Matting — Rubber Hose — Grommets — Shock Absorber Cord — A Complete Line of Rubber Aeronautical Accessories.



# New High-Wing Aeronca Model K

● Embodying mechanical advancements and engineering refinements, as well as an entirely new appearance, the Aeronca Model K, powered by the 40 hp Aeronca E-113C engine, is a two-place strut braced monoplane intended to replace the Model C-3 high-wing in production.

The first plane in this series was flown to New York just prior to the opening of the National Aviation Show. It was demonstrated at North Beach Airport and then shown publicly for the first time in the Grand Central Palace.

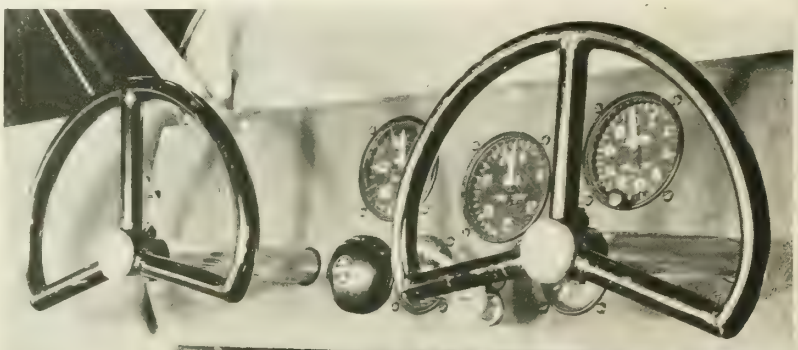
Designed for two persons in a roomy cabin measuring 35" wide at the seat, the Model K fuselage is constructed of welded steel tubing, faired with wood stringers and wood bulkheads, the whole being fabric-covered. Chrome-molybdenum tubing is used in the majority of the structure of the fuselage.

Entrance to the cabin is on the right side, through a large door, providing easy access to the side-by-side seat. Dual wheel controls operating through the instrument panel allow spaciousness in the cabin and eliminate floor obstructions. Either set of wheels can be removed as can the rudder pedals on the passenger's side.

Forward vision from the cabin is enhanced by a large rounded Plastacele windshield, as well as the lines of the forward end of the fuselage including the cowling and instrument panel. There are two windows—one on the pilot's side and the other in the door on the right side, which can be lowered to allow an exit measuring 22" × 12"; these windows also are adjustable to any degree of opening and when fully up offer no obstruction to vision as there are no sections in the window. Standard automobile-type felt-lined window channel is used as an effective means of eliminating draft. Vision is also aided by the use of a small overhead window and by small slightly curved windows to the rear, on each side.

The instrument panel is mounted in a well-lighted position and the instruments are grouped at the center, together with the throttle control. Instruments consist of an Aeromarine altimeter, tachometer, airspeed indicator and oil pressure and temperature gauges. Directly forward of the panel is a 10-gal. fuel tank which has a sight rod gauge in the cap. Provision for this amount of fuel shows an increase of 25% over that in the previous model.

(*Continued on following page*)





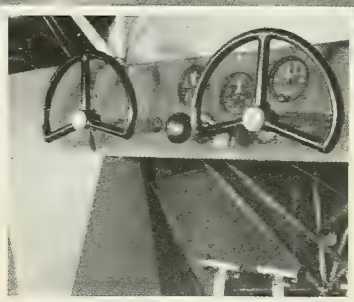

***Instrument panel and dual control wheels of the Aeronca Model K. At the center is the engine throttle control around which are grouped the five flight and engine instruments which are easily visible from both seats. The view below shows the clean lines of the Model K in profile***

# Spectacular!

NEW 1937 AERONCA



## Sets new light plane STANDARDS...



When you **see** the New 1937 Aeronca – when you **fly** it – you will never be satisfied with anything less!

It is the Aristocrat of Light Planes – streamlined from nose to tail, clean, trim, beautifully finished inside and out.

The spacious cabin has the de luxe appointments of a modern transport – abundant head, shoulder and leg room, side by side seat fully 35 inches wide, a clean, unobstructed floor, wheel control, direct-vision instrument panel, excellent visibility, wide door permitting easy access or exit, commodious baggage compartment.

For business or sport it fills every essential need. A cruising speed of 80 to 85 miles per hour – a top speed of 93; a cruising range of 250 miles; a combined passenger and baggage allowance of 214 pounds – at an astonishingly low gas and oil consumption.

All at no increase in price! You can buy the New 1937 Aeronca for as little as $530 down, balance on easy terms. Write for complete description and name of Aeronca dealer.

You are due to revise, **upward**, all previous conceptions of what constitutes an **ideal training** ship, when you fly the New 1937 Aeronca.

For, in addition to the factors which made former models the overwhelming choice of field operators and student fliers – ease of handling, maneuverability, stability, absolute dependability, combined with a rugged constitution – the New 1937 Aeronca offers these outstandingly important PLUS-FEATURES:

Dual wheel control ● Side by side seating ● De Luxe, roomy cabin ● Excellent visibility in all directions ● Clean, uncluttered floor ● Push-pull throttle within easy reach of both instructor and student ● Well-lighted instrument panel ● Seat cushions interchangeable with parachutes, (when necessary), without altering angle of vision ● Elevator adjustment from cabin ● Improved tail skid ● Single-strut oleo landing gear . all without extra cost!

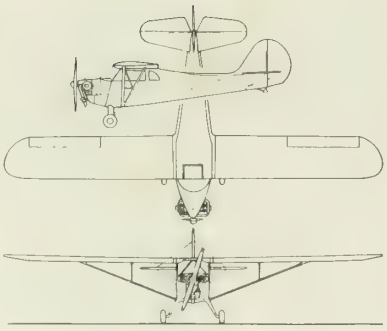
**AERONAUTICAL CORPORATION OF AMERICA • Lunken Airport • Cincinnati, O.**

*(Continued from preceding page)*

Interior of the ship is finished with fabric and doped to give a finish comparable to that used in an automobile of the open type. Paratex seat cushions (rubberized hair) are used, the finish being artificial leather. The seat cushion is cut off at the door side so as to facilitate entrance and give more foot room. Seat cushion and back are supported on a canvas sheet attached to two structural members, and the cushions are arranged to be removed so parachutes can be worn by the pilot and passenger.

Wings are attached to the cabin and fuselage at either side by two bolts and are supported by streamline struts to the fuselage. Solid spruce spars are used with a single drag trussing system and conventional Aeronca spruce truss ribs with fibre gussets. An aluminum metal leading edge gives shape to the nose of the Clark Y airfoil section. The tip of the wing is rounded and some dihedral has been built into it to reduce the dihedral required for lateral stability in the entire wing.

Right and left ailerons are interchangeable and are of the semi-Frieze type with dural framework which is fabric covered and doped. They are mounted on 3 replacable hinges and are operated through a loop cable system.



*Outlines of the Aeronca Model K*

Tail surfaces are of welded steel tube construction, fabric covered and doped and wire-braced to the fuselage. There is an adjustable tab trimming on the left elevator, the control being overhead in the cabin and of the automobile window lift type. The fin is integral with the fuselage, and encloses the elevator horn.

Tail skid assembly consists of a spring in the tail post to absorb landing and taxiing shock. A plunger below this spring attaches to an arm carrying a standard chilled cast iron shoe. Connections between the plunger and the arm carrying the shoe have rubber bushings to reduce noise and wear. A bag covers the entire assembly to prevent dirt from getting into the sliding member.

Landing gear is of the individual strut type and is bolted to the fuselage structure. In each leg is an oleo which is restrained from rotating by a "nut cracker" arrangement which connects the oleo sliding member with the rigid leg of the gear. Axles are welded to the lower end of the oleo. Goodyear Airwheels 16 × 7-3 are standard equipment and may be equipped with Goodyear brakes at extra cost.

Specifications and performances of the Aeronca Model K powered with the Model E-113C engine are as follows:

| | |
|---|---|
| Wing span | 36 feet |
| Overall height | 6 feet 8 inches |
| Overall length | 20 feet 7 inches |
| Wing area | 146.4 square feet |
| Empty weight | 590 pounds |
| Useful load | 450 pounds |
| Gross weight | 1040 pounds |
| Wing loading | 7.79 lbs./sq. ft. |
| Power loading | 26 lbs./hp |
| Fuel capacity | 10 gallons |
| Oil capacity | ¾ gallon |
| Maximum speed | 93 miles per hour |
| Cruising speed | 85 miles per hour |
| Landing speed | 35 miles per hour |
| Rate of climb | 450 feet per minute |
| Cruising range | 250 miles |


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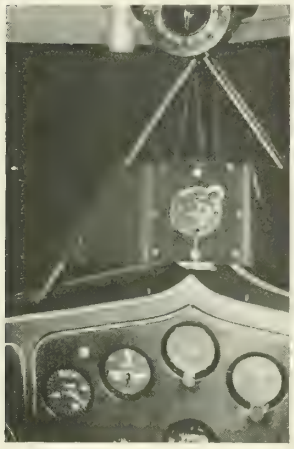
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# The W. I. T "Air-Track" System of Instrument Landing

● Based on the tried and proven principles of the original Bureau of Standards system (AERO DIGEST, Oct.-Nov. 1936), the "Air-Track" system of instrument landing, developed by Washington Institute of Technology, provides the pilot with a constantly and automatically defined three-dimensional gliding path from a point in space to a selected runway within the airport limits.

Profiting by experience gained in recent years, both in this country and abroad, the W.I.T. engineers evolved a practical and versatile instrument landing system of immediate commercial value, and proved their contentions by convincing demonstrations at their experimental airport at College Park, Md., where their Air-Track is now in operation.



A salient feature of the apparatus is its mobility. The entire ground equipment, including antenna arrays for directional and vertical guidance, is compactly mounted in an automobile trailer. The steepness of the gliding path may be regulated at will, to allow for obstructions or to suit the optimum gliding angle of the craft involved in making an instrument landing. This is the first instance of a three-dimensional landing system being available in mobile form, and the military importance of this feature is obvious. In commercial service, this feature permits using a single mobile unit to serve any number of runways at one airport.

The 3-fold landing information furnished by the Air-Track is transmitted by equipment consisting of a 4-course localizer beacon operating within airway range beacon frequencies (200 to 400 kc.); an ultra-high-frequency unidirectional glide path beacon (91-000 kc.); and a field boundary radio marker beacon operating on the localizer frequency.

The localizer beacon for directional guidance is similar in principle to the familiar radio range beacon, but instead of interlocking "A" and "N" signals employs two different modulation frequencies: 65 and 86-2/3 cycles respectively. The equisignal zone, or "beam," is interpreted visually by a reed converter actuating the vertical pointer of the landing instrument. This permits a sharper definition of the directional path than is possible aurally, as the human ear is normally sensitive to a difference in sound of not less than 2 decibels, giving an apparent breadth to the beam.

It should be noted that the present airport frequency (278 kc.) is satisfactory for standardized coast-to-coast use for instrument landing with this system; furthermore, the low frequency modulation of the localizer (65 and 86-2/3 cycles) would permit simultaneous use of this frequency for both instrument landing and voice communication. Such simultaneous transmission would necessitate only a condenser in series with headphones, to eliminate the beacon signal hum, instead of a filter as needed in the present simultaneous range beacon and voice transmitters.

Vertical guidance is provided by an ultra-high-frequency transmitter radiating a pear-shaped pattern directed slightly upward; the pear-shaped lines of constant field intensity provide a number of glide paths of varying steepness, converging at the runway. The horizontal pointer of the landing instrument is preadjusted to assume horizontal position when the ship follows the optimum line of constant field intensity. This adjustment would hold valid for any airport, or any approach to a a given airport, as the necessary variations in the glide path, to clear obstructions, are made on the ground by setting the glide path transmitter control to a predetermined value for each runway.

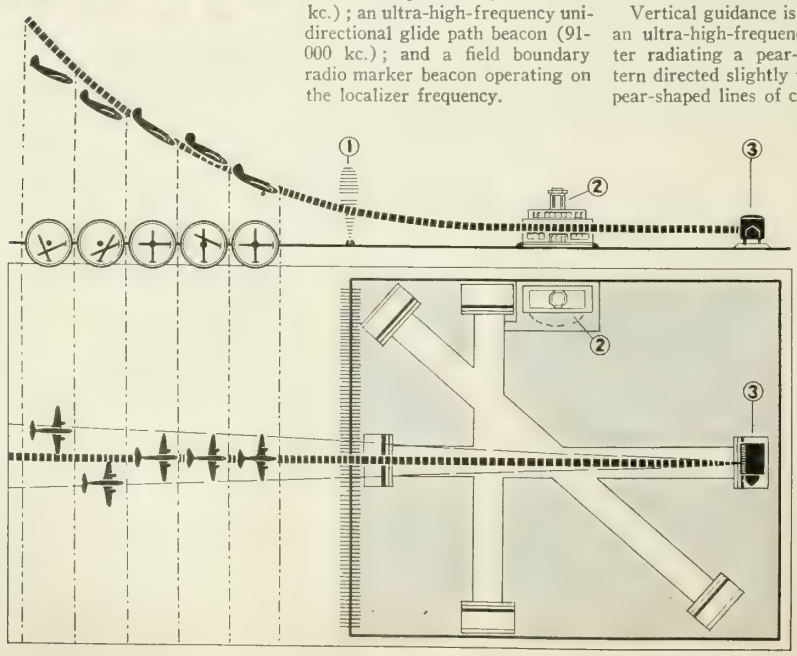
Longitudinal guidance is provided by a low-power ultra-high frequency marker beacon at the edge of the runway, with radiation directed sharply upward and modulated by a suitable audio-frequency note (1000 cycles at College Park), forming a "wall of sound" through which the airplane must pass. At this point the airplane's horizontal receiving antenna is 15 to 25 ft. above the ground, and the actual landing can be accomplished without difficulty.

In the present installation, the marker beacon operates on the same frequency as the localizer; however, it is proposed to employ an ultra-high-frequency for this purpose (75,000 kc.), which would necessitate a small additional receiver.

Perhaps the greatest single achievement of the Air-Track is the inherent reliability of its operation because of automatic monitoring and simple and practical centralized control.

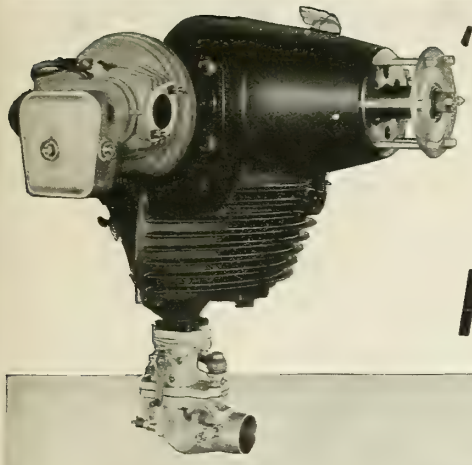
Each trailer station is equipped with a concrete trough for trailer wheels, and a trailer locking device, assuring reasonably constant

(*Continued on page 64*)





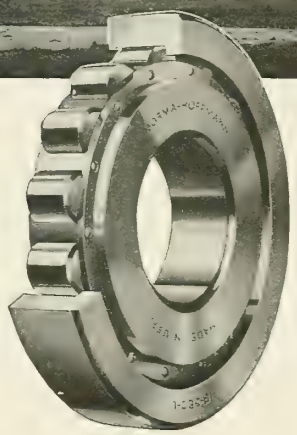

Schematic diagram showing (1) boundary marker beacon, (2) control room, and (3) trailer in position



# "AERONCA," too, Invests in PRECISION



The "Aeronca" E-113-C Engine, which powers the new "Aeronca" High Wing Monoplane, carries its crank shaft on two NORMA-HOFFMANN PRECISION ROLLER BEARINGS (type "R-L" as illustrated to the right) thereby providing extra capacity and a larger factor of safety. * * * The Aeronautical Corporation of America, Cincinnati, O.—pioneer builders of light planes—thus expresses its continued confidence in NORMA-HOFFMANN BEARINGS and, on a basis of past experience, again endorses their performance.



The NORMA-HOFFMANN PRECISION line of ball, roller and thrust bearings comprises 108 distinct series embracing over 3000 catalogued sizes—a PRECISION Bearing for every load, speed, and duty. Write for the Catalog and the NEW booklet on Aircraft Control Bearings. Let our engineers work with you.

*"Where the bearings must not fail"*—on land, at sea, and in the air—NORMA-HOFFMANN Precision Bearings are the choice of engineers and designers of planes, engines (including superchargers), engine accessories, control apparatus, instruments, radio equipment, cameras, and landing field equipment.

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**PRECISION BEARINGS**

Ball — — — — — — Roller — — — — — — Thrust

**NORMA-HOFFMANN BEARINGS CORP'N., STAMFORD, CONN. U.S.A.**

## Newest Developments in the Field of Aircraft Radio

### Bendix Makes PAA D-Fs

Long-range direction finding apparatus for ground stations, developed by Pan-American Airways and successfully used by them on their routes since 1928, will be made available to the entire industry by Bendix Radio Corp. who obtained sole rights for its manufacture. Work will be carried on in their Washington plant, and eventually will be transferred to the new plant to be constructed at Teterboro, N. J.

The Pan-American D-F is essentially an improvement of the well-known Adcock system (AERO DIGEST, Feb. 1937), which is inherently the most accurate and the most stable system of radio direction finding. It employs a stationary 4-antenna array, approximately 150 ft. square. Direction of the incoming signal is determined by a search-coil goniometer, and the slight octantal error of the system is kept to a minimum by selecting an electrically satisfactory site, and finally eliminated by calibrating the indicating dial for direct reading in degrees throughout the circle.

In 9 years of practical operating experience, PAA engineers have introduced many refinements in the original system and evolved an instrument of phenomenal range and accuracy. The latest PAA D-Fs are now being used in regular airline operation on ranges up to 2200 miles, and have successfully given bearings up to 3800 miles. The outstanding achievement was the utilization of short waves for radio direction finding—a feat heretofore considered impossible though highly desirable. Another feature of the equipment is that it effectively overcomes night effect, fading, tropical static, rain and snow static (but not sunrise and sunset effect).



*Pan American direction finder station at Alameda*

Use of ground direction finders permits installation of far more precise equipment than is possible within the limited space aboard an airplane. The navigational procedure is precisely the reverse of the usual practice (AERO DIGEST, Nov. 1936, Feb. 1937): the airplane transmits a long dash, and the ground station determines its bearing, position and direction of flight, relieving the flight crew of complex navigational problems.

The equipment will be available for installation only within the United States and its possessions.

### "Z" Marker Beacon

Intended primarily to supplement the cone of silence of radio range beacon stations, the recently announced Bureau of Air Commerce "Z" radio marker beacon transmits a sharply defined vertical beam, and serves to indicate the position of aircraft when above the beacon station. Trial installations of the latest version have been made at Chicago, Kansas City, Newark, and Washington, the latter being reserved for further experimentation.

The transmitting antenna array consists of horizontal half-wave doublets supported one-quarter wave above the ground, radiating from a common center. The antennas are fed at the common center through a special arrangement of down-leads, providing balanced currents to all four antenna units, and a 90° phase difference between the currents in adjacent antennas. For monitoring purposes, some of the radio-frequency signal is filtered and coupled to the control line leading from the marker site to the airport control room, where the signal is used to operate a meter indicating the operating condition of the transmitting equipment.

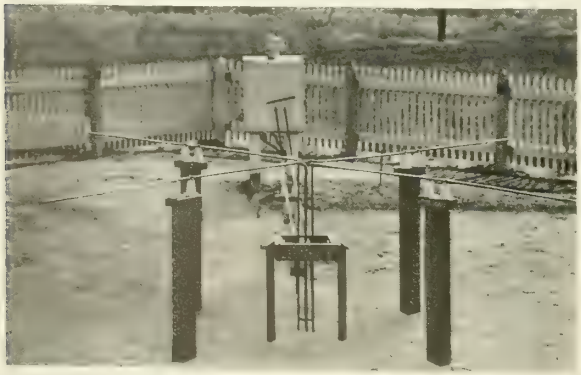
The new installations operate on a frequency of 75 mc., with 3000-cycle modulation. All of the original experimental markers, operating on 91 mc. with 60-cycle modulation, have been shut down.

A special ultra-high-frequency 6.25 lb. airplane receiver, used in conjunction with the marker, provides both aural and visual indication. The aural indication is obtained by connecting the audio output of the marker receiver in parallel with the output of the regular range beacon receiver. As the ship passes over the range station, the marker signal is heard superimposed on the range signal; being of high pitch, the marker signal causes no interference with reception of the beacon signals. The marker becomes audible slightly before the ship enters the cone of silence, increasing rapidly to a predetermined value where it remains constant over a short period (depending on speed and altitude), then fades away. At 3000 ft., with a ground speed of 100 mph, the audible signal lasts approximately 27 sec., with receiver sensitivity of 460 microvolts.

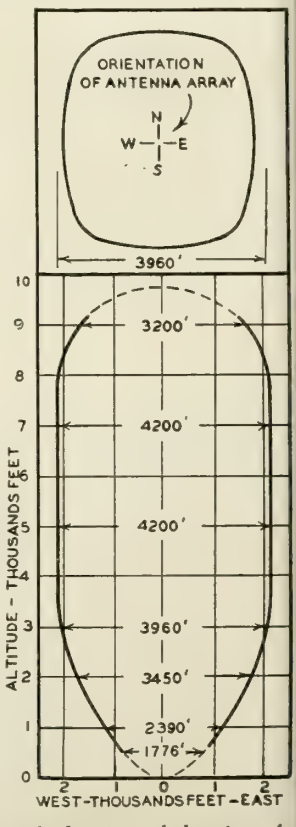
Visual indication is obtained by a standard 12-v. white light which flashes on the instrument board, remaining lighted over most of the period that the marker signal is audible. Output circuit of the receiver contains a 3000-cycle band pass filter, to avoid erroneous indications.

The radiation pattern of the marker is free of dead spots or lobes, and is substantially circular in cross-section. It spreads rapidly from the ground up to 3000 ft., and then remains nearly constant to its maximum height of approximately 9000 ft. By increase of power and some sacrifice in the narrowness at lower altitudes, it is possible to provide a marker pattern extending above that altitude for specific locations. The present equipment is capable of such increase without alteration, as the present power output is only about 5 watts.

(*Continued on following page*)



*Transmitting antenna array of "Z" marker beacon*




*Side elevation and plan views of "Z" marker radiation pattern*



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**RYAN S-T**

RYAN AERONAUTICAL COMPANY
LINDBERGH FIELD, SAN DIEGO, CALIFORNIA

*(Continued from preceding page)*

## UAL Radio Research

A twin-engined stock transport airplane has been outfitted by United Air Lines as a complete flying radio laboratory. The ship carries four types of antistatic antennas, as well as radio receivers designed for greater range and quality in reception. It is also equipped with instruments to record humidity, temperature, barometric pressure, effect of electrical charges of clouds on the airplane structure and de-icing equipment (AERO DIGEST, Dec. 1936).

With 8 engineers and scientists on board, the ship left Chicago March 12 for a series of experimental flights between Portland, Ore., and Salt Lake City. The schedule calls for daily flights in all weather conditions, for a thorough test of the new equipment developed by United.

H. M. Hucke, United's radio engineer, is in charge.

## Radio Meteorograph

A new radio meteorograph, developed by the Radio Section of the Bureau of Standards for use in the meteorological service of the U. S. Navy Department, permits gathering complete information on upper-air conditions required for weather forecasting, and is expected eventually to replace the use of airplanes for this purpose. The development was under the direction of H. Diamond, W. S. Hinman and F. W. Dunmore.

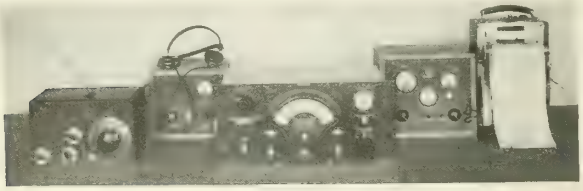
The instrument, sent aloft on a 5-ft. balloon, consists of a miniature radio transmitter, batteries and a meteorograph which contains the devices for measuring pressure, temperature, humidity, and other elements desired. The complete apparatus is housed in a balsa-wood box, 6" × 6" × 45", and weighs under 2 lbs.

The meteorograph utilizes the decrease in atmospheric pressure as the balloon rises for moving a small switch arm over a set of electrical contacts separated by insulating strips. The contacts are so spaced that for a decrease in air pressure equivalent to a few hundred feet rise of the balloon the arm will move from one contact to the next, causing the radio transmitter to send signals having predetermined audio notes identifying these contacts.

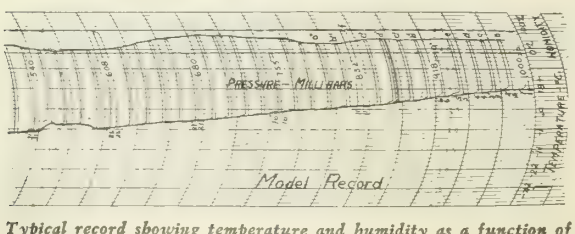
Contacts intermediate to the pressure-identifying contacts are wired to a resistor controlled by a bundle of human hair, and hence varies as the hairs contract or expand because of varying humidity conditions. The switch arm passing over these contacts connects this variable resistor into the transmitter circuit so as to send signals having an audio note proportional to the value of the resistor.

When the switch arm passes over the insulating strips lying between the contacts, the frequency of the audio note is determined by the electrical resistance of a small glass tube filled with sulphuric acid. The resistance of this column of acid changes markedly with temperature so that the transmitted note may be interpreted to evaluate the air temperatures at the various balloon heights.

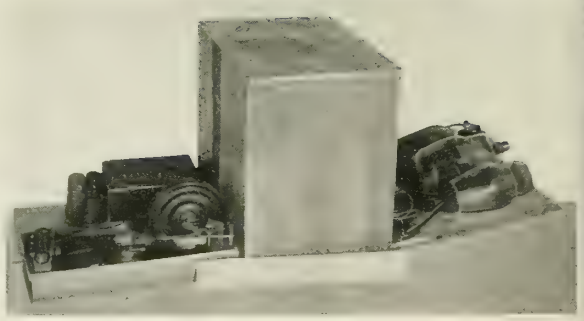
In one form of the meteorograph, light intensity may also be measured, giving data for determining the heights and vertical structure of existing cloud formations. Measurements of light intensity at different heights may be obtained by wiring certain of the contacts to a photo-electric cell whose electrical resistance varies proportionately to the amount of light impinging on it. This variable resistor, in turn, controls the audio note of the transmitter.



*Ground station receiving and recording equipment*




***Typical record showing temperature and humidity as a function of barometric pressure. Frequency traces at left (1, 2, 3, etc.) give temperature variation graph—those at right (a, b, c, etc.) give humidity variation graph***



***Complete radio meteorograph equipment is housed in balsa wood box. Note the diaphragm of the pressure-switching unit***

Automatic receiving and recording equipment at the ground station is employed to plot these data graphically on a chart which moves under a pen controlled by the received signals. The pen sets itself according to the pitch of the audio note being received. The final record gives a complete picture of the variation of temperature, humidity and light intensity as a function of height above the earth's surface.

To evaluate upper-air wind directions and velocities, it is necessary to measure continuously the distance and azimuthal direction of the balloon from the ground station. Usual direction finding methods, if applied to this problem, would require two or more ground direction finder stations, from 10 to 20 miles apart. The Bureau of Standards system, however, contemplates the use of a single ground station, at which both the direction in azimuth and the angle of elevation of the balloon are measured. Initial experiments with this new method of radio direction finding are now in progress. Knowing the angle of elevation and the height of the balloon (the latter from the graphic indications of pressure, temperature and humidity obtained), the distance of the balloon from the ground station may be readily computed.

During recent years many experimenters have worked on the development of radio meteorographs. Practically all of the devices developed use a clockwork, fan motor, electric motor, or some other source of motive power, to carry out the switching operations necessary in translating the mechanical deflections of meteorological instruments into radio signals which may be interpreted on the ground. This radio meteorograph employs a novel arrangement of causing the changing air pressure to do the switching.

The number of observations obtained during an ascent is independent of the rate of ascent of the balloon; as a result, a high rate of ascent may be used to reduce the total time required for a complete set of observations. For such rapid indications, it is necessary that the temperature and humidity devices respond instantaneously to changes in these elements. The column of sulphuric acid solution meets this requirement, responding much faster than the conventional bimetallic thermometer.

A paper describing this apparatus in detail will appear in a forthcoming issue of the *Journal of the American Meteorological Society.*

## W. I. T. "AIR TRACK"

*(Continued from page 60)*

and stable alignment of the transmitting antennas. Coupling the trailer's electrical conduits to the weather-proof outlets at the station automatically connects the corresponding marker beacon at the opposite end of the runway. The system's monitoring equipment is located in the trailer, operated by time-delay switches.

The three transmitters (localizer, glide path and marker) are controlled from the central control board, a red light opposite each switch indicating that the equipment is functioning. After a short interval, the monitors are automatically cut in, and if the transmitting equipment is functioning correctly, an appropriate green light flashes on the control board. Any irregularity in transmission (in excess of predetermined limits) causes the monitoring equipment to shut off power and flash the warning to the control board. After the necessary correction is made, the monitor switches must be reset by hand before the green safety light flashes on the control board, regardless of whether the equipment now functions correctly or not, thereby assuring constant and automatic check on its performance. Telephone communication is provided between the trailer and the control board.

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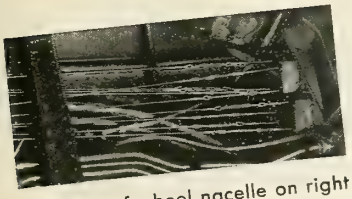
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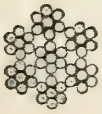
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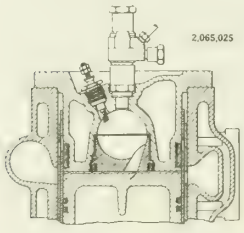
Streamline ◆ Square ■ Round ●

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# RECENT AERONAUTICAL PATENTS

● The following recent patents of interest to readers of AERO DIGEST were compiled from the Official Gazette of the United States Patent Office:

Internal combustion engine of




the liquid fuel injection compression ignition type. Harry Ralph Ricardo, London, England. (2,065,025)

Valve for internal combustion engines. Frank Ernest Bullock, Coventry, England. (2,065,049)

Vehicle ventilator. Lionel Lynes, London, England. (2,065,085)

Forming machine. James L. Simmons, Colmar Manor, Md., assignor to Engineering & Research Corp. (2,065,102)

Method and apparatus for testing metals for defects, and flaw detection. Archibald H. Davis, Jr., New Castle, Pa., assignor to Steel & Tubes, Inc. (2,065,118 and 2,065,119)

Rotary wing for airplanes and the like. Frederick Wander, Jr., Bronx, N. Y. (2,065,254)

Airplane. George Schottroff, Yankton, S. Dak. (2,065,401)

Internal combustion engine fed by heavy fuels. Albert Bafnulo, Courbevoie, France. (2,065,419)

Electrical indicator and tachometer. Walter H. Campbell, Osborn, Ohio. (2,065,426)

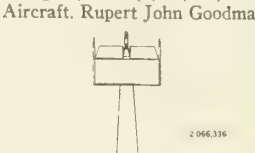
Wind tunnel balance. Porter H. Adams, Thetford, Vt. (2,065,496)

Piston and connecting rod construction. William Crawford Bell, Baltimore and William Nicholas Fischer, Baltimore County, Md. (2,065,509)

Airplane. Edmund P. Gaines, Columbia, S. C. (2,065,684)

Bath for anodic treatment of aluminum. Robert W. Buzzard, Kensington, Md. (2,066,327)

Aircraft. Rupert John Goodman




Crouch and Harold Bolas, Pawtucket, R. I. (2,066,336)

Process for improving aluminum alloy. Alfred J. Lyon, Dayton, Ohio. (2,065,534)

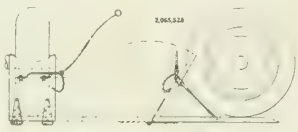
Valve spring retainer lock. Archie T. Colwell, Cleveland, Ohio, assignor to Thompson Products, Inc. (2,065,794)

Centrifugal compressor. Charles Raymond Waseige, Rueil-Malmaison, France, assignor to Eclipse Aviation Corp. (2,065,955)

Signaling means (for aircraft). Glenn Muffly, Detroit, Mich. (2,066,156)

Flexible airplane wing construction. Rolland C. Sabins, St. Paul, Minn., assignor to Mechanical Development Co. (2,066,649)

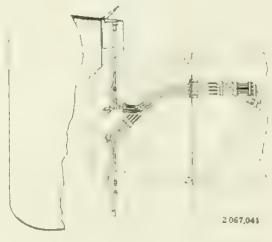
Chuck for airplane wheels. Carl




H. Jolly, U. S. Navy. (2,065,528)

Aircraft engine synchronizing system. William S. Berry, Hagerstown, Md., assignor to Pioneer Instrument Co., Inc., (2,066,819)

Engine cooling means. Rex B.




Beisel, West Hartford, Conn., assignor to United Aircraft Corporation. (2,067,041)

Craft navigating apparatus. Albert L. Ruiz, Schenectady, N. Y., assignor to General Electric Co. (2,066,949)

Multiple propeller driving means. George R. Schleicher, New York, N. Y. (2,067,023)

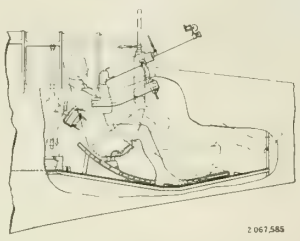
Rotary sustaining wings for aircraft. James Allen Jamieson Bennett, Gnista, Newton Mearns, Scotland, assignor to Autogiro Co. of America. (2,067,228)

Metal building construction. William C. Lea, Los Angeles, Calif. (2,067,403)

Time delay power control system and apparatus. Ross J. Plaisted, Brecksville, Ohio, assignor to Aircraft Service, Inc. (2,067,413)

Glider. Clement J. Sohn, Lansing, and Arthur J. Davis, E. Lansing, Mich. (2,067,423)

Gunner's seat and mounting.




Clem G. Trimbach, Kenmore, N. Y., assignor, by mesne assignments, to Curtiss-Wright Corp. (2,067,585)

Control compass for automatic piloting of moving bodies. Wood Freeman, Fircrest, Wash. (2,067,441)

Method of a means for indicating relative angular movements. Adolf Urfer, Richmond Hill, N. Y., assignor to Pioneer Instrument Co., Inc. (2,067,467)

Inclinometer. Victor E. Carbonara, Rockville Centre, N. Y., assignor to Bendix Aviation Corp. (2,067,474)

Deicing means. Kenneth A. Browne, Concord, Mass., and Willard B. Goodman, Paterson, and Donald J. Lowman, Clifton, N. J., assignors, by mesne assignments, to The Reed Propeller Co., Inc. (2,067,595)

Spark plug bushing and shield. Joseph J. Mascuch, Newark, N. J. (2,067,614)

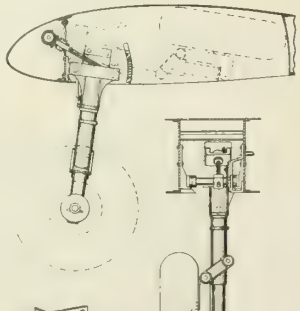
Rotative wing aircraft. Raoul Hafner, Vienna, Austria. (2,067,633)

Aircraft tailplane. Raoul Hafner, Vienna, Austria. (2,067,634)

Airplane. James V. Martin, Garden City, N. Y. (2,068,300)

Clutch device for starting mechanisms. Romero M. Nardone, East Orange, N. J., assignor to Eclipse Aviation Corp. (2,068,461)

Retractable landing gear. Roy




W. Morse and Lyle A. Wood, Seattle, Wash., assignors to Boeing Airplane Co. (2,065,146)

Cowling attachment. Théophile de Port, New Carlisle, Ohio. (2,067,904)

Engine starting apparatus, and starting mechanism. Romeo M. Nardone, East Orange, N. J., assignor, by mesne assignments, to Eclipse Aviation Corp. (2,068,462 and 2,068,463)

Lock nut. Albert Stoll, Detroit, Mich., assignor to Clare L. Brackett. (2,068,613)

Gyroplane. Edward Burke Wilford, Merion and Elliot Daland, Philadelphia, Pa.; said Daland assignor to said Wilford. (2,068,617)

Engine cooling device. Walter F. Davis, Farmingdale, N. Y., assignor, by mesne assignments, to Ranger Engineering Corp. (Reissue 20, 251)

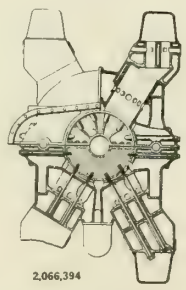
Aircraft. Beauford B. Smith, Silverton, Oreg. (2,068,774)

Dirigible. Roland B. Respess, Wickford, R. I., assignor to Respess Aeronautical Engineering Corp. (2,068,870)

Internal combustion engine. Robert Suczek, Detroit, Mich. (2,068,878)

Aircraft and the control thereof. Fred M. Truman, Ambler, Pa. (2,066,375)

Internal combustion engine




structure. Rudolph Daub, Paterson, N. J., assignor to Wright Aeronautical Corp. (2,066,394)

Aircraft control. James G. Ray, Hatboro, Pa., assignor to Autogiro Company of America. (2,069,047)

Aerial flare. Giacinto Tabozzi, Milan, Italy. (2,069,101)

Recording tachometer. Ulrich Kohler, Bern, Switzerland, assignor to Hasler A.-G. vormals Telegraphenwerkstätte von G. Hasler. (2,069,152)

Safety device for airplane automatic pilots. Bert G. Carlson, Queens Village, N. Y., assignor to Sperry Gyroscope Co., Inc., (2,069,214)

Control arrangement for motors, particularly rudder motors. Eduard Fischel, Berlin-Charlottenburg, Germany, assignor to Siemens & Halske, Aktiengesellschaft, Siemensstadt. (2,069,605)




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# Digest of Technical Articles from Foreign Publications

### Aircraft and Engines

*Reprospective Technical View of the* 1936 *Paris Aircraft Show. (Technischer Rückblick auf die Luftfahrtausstellung in Paris* 1936. *Luftwissen; Bd.3, No.* 12; *December* 1936, *Berlin*)

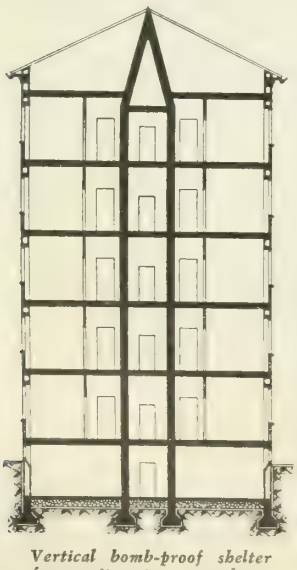
Despite the comparative briefness of the descriptive text, this article is particularly valuable because of the completeness of the technical data giving dimensions, weights and performance of the engines and aircraft exhibited. Data is presented in tabular form and accompanying photographs round out information on the most interesting types shown at the Paris Salon. Information is provided on 48 airplanes and 86 engines, most being of European exhibitors.

### Air Defense

*Vertical Type of Anti-Aircraft Shelter with Deflecting Roof Having Greatly Sloping Sides (Di un Tipo Verticale di Ricovero Antiaereo con Copertura Deviante a Falde Fortemente Inclinate; Capitano G. A. Domenico Priolo, Rivista Aeronautica, N.* 11; *Novembre* 1936)

The question of protection of the civilian population of cities is apparently becoming of immediate importance. In the author's opinion the accepted type of bomb-proof cellars suffers many disadvantages both technical and psychological and he proposes a new type of cover which would fit in better with normal peace conditions yet afford immediate safety during war times. The articles propose that all buildings of moderate size incorporate, in a sense, a tower having massive walls and ending with a highly sloping roofed extension. This slope is intended to deflect the bomb thus preventing the destruction by direct demolition and, hence, constructing the rest of the building to withstand the effect of the power of the air shock only.

The building as a whole should be designed on the principal of construction intended for earthquake zones. The bomb-proof shelter is equipped with ventilation means, rations and various types of anti-gas equipment.



*Vertical bomb-proof shelter for a city apartment house ("Revista Aeronautica")*

### Engines

*Centrifugal Blowers for Aircraft Engines. Functioning and Power at Altitude of the Engine-Blower Group (Compressori Centrifughi per Motori d'Aviazioni. Funzionamento e Potenza in Quota del Gruppo Moto-Compressore, Ing. Ruggero Chiappulini; L'Aerotecnica; Vol. XVI, No.* 10; *Ottobre* 1936)

Making use of the studies of R. S. Capon and G. V. Brooke, the author analyses the characteristics of centrifugal blowers of aircraft engines and the engine proper. He arrives at definite laws connecting power output with the performance of the blower thus defining the variation of horsepower with altitude as a function of blower gear ratio, temperature, density and pressure. The resulting equation is somewhat complex and the author points out that on the basis of observation and collected data the work of numerical computation can just as readily be obviated by using observed averages. The article gives a table of power variation with altitude obtained by the author from numerous observations on typical aircraft engines. From the data given it can be stated approximately that the reduction of power with altitude is about 7% less than that for ordinary engines.

### Meteorology

*Monthly Normals of Percentage Frequencies of Surface and Upper Winds Over Malta, Egypt, Palestine, Trans-Jordan and Iraq, M.* 0.405, *Meteorological Office, Air Ministry, Great Britain.*

Tables incorporated in this report give monthly summaries of the percentage frequencies of winds of various speeds and directions at selected heights as observed at certain stations located in the places given by the title. The record extends over a period of eleven years (1921-1932) for upper wind observations and five years (1927-1932) for surface wind summaries.

### Aircraft and Engines

*The Fifteenth Paris Salon; Trends of Aeroplane and Engine Development as Exemplified in the Exhibits. W. S. Farren; Aircraft Engineering; Vol. IX, No.* 95; *January* 1937

Farren's review of the Fifteenth Paris Salon gives brief descriptions of the salient features of various aircraft and engines displayed. Particularly noticeable is the general trend of French aircraft towards obtaining high speeds without regard to cost or weight. Among foreign exhibits, the author stresses the new Fokker two-seat fighter and Koolhoven single-seat pursuit which, in his opinion, are designed solely around armament. As regards engines, the author stresses the overwhelming predominance of the air-cooled type with a general tendency toward compactness. The 14-cylinder, two-row radial type is generally becoming popular in the high power class. United States exhibit of engine and propellers—Curtiss-Wright engines and Hamilton Standard propellers, in words of Farren, still seems to set an example for the world to follow.

### Aerodynamics

*The Contribution of the Body and Tail of an Aeroplane to the Yawing Moment in a Spin. H. B. Irving, B.Sc., A. S. Batson, B.Sc., and J. H. Warsap of the Aerodynamics Department, N.P.L. Air Ministry (Great Britain). Aeronautical Research Committee Reports and Memoranda No.* 1689, *November,* 1935.

Two important points in spinning have been known for some time. They are, first, that a yawing moment acting against the spin is the most effective means of preventing the flat spin or of bringing a plane out of a spin. Second, that the fin and rudder, whose function it is to provide such an anti-spin yawing moment, are liable to become largely shielded or even reversed by the tailplane during spinning.

The effects due to the following were studied and are reported in this paper: change of profile and plan form; change of body section (flat, square, circular, rectangular, elliptical, semicircular top, semicircular bottom); addition of narrow strips along these last two bodies; variation of tailplane aspect ratio and shape (aspect ratios 2, 3 and 4—rectangular—and triangular); variation of tailplane position (fore and aft and up and down); variation of disposition of a given vertical fin surface, (e. g., tall vertical surface, long vertical surface and surface below tailplane each side of plane of symmetry).

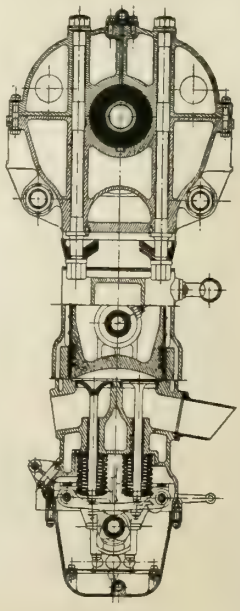
Wing interference was also studied in a number of cases both as regards the magnitude of the interference due to wings of different arrangements (high and low wing monoplane, and biplane) and as regards its effect on the comparison of body and tail.

### Flutter

*Flexural-Torsional Oscillations of a Wing in a Uniform Air Stream. (Le Oscillazioni Flesso-Torsionalli di un'Ala in Corrente Uniforme. P. Cicala; l'Aerotecnica; Vol. XVI, No.* 11; *November* 1936)

Having arrived at the conditions necessary for a stable state of flexural-torsional vibrations of a wing of finite aspect ratio, the author indicates a graphical method for the determination of the critical flutter speed. In addition, this method permits the evaluation of the frequency, relative amplitude, and phase of the component motions. The author feels that the present method and calculations based on its use serve only as a general guide since even the mean values of aerodynamic coefficients used in the equations are not known with certainty. The graphical method suggested, however, is useful to designers in forming a clearer picture of the interplay of different variables and their effect on the magnitude of the critical speed.

(*Continued on following page*)



*French Jalbert 125-150 hp Diesel-type aircraft engine ("Review du Ministere de l'Air")*

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**TWO-WAY AVIATION RADIO TELEPHONE AND TELEGRAPH EQUIPMENT**

(*Continued from preceding page*)

## Aerodynamics

*On the Take-Off of Airplanes (Sul Decollo degli Aeroplani, Cap. G.A.R.I. Carlo Mazzoni, Rivista Aeronautica, N. 12, Dicembre* 1936)

The problem of take-off has been treated in numerous papers and was previously rigorously treated in another of the author's papers on the subject (*L'Aerotecnica,* April 1933). This article reviews various functions which enter into the problem and analyses their relative importance. Having shown the influence of different variables, the author explains the use of two charts he prepared for rapid calculation of the take-off as a function of wing and power loadings. The nature of the approximation is such as to give only a general idea of the time and distance required since it neither states what general type of propeller was assumed for thrust grading curve nor indicates the average airplane characteristics on which the charts were based. The article also includes the effect of wind and altitude on take-off approximated in a similar manner.

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*Aerodynamics of High Speeds. Revue of Volta Meeting of* 1935. (*L'Aérodinamique des Grandes Vitesses. En Marge du Congres Volta* 1935, *Wladimir Margoulis. La Technique Aéronautique, No.* 140, 2e *Trimestre* 1936.)

This paper was read by the author at the Conference of Cercle d'Etudes Aérotechnique on March 26, 1936. It is an excellent synopsis of the vast material presented by various authors at the Fifth Volta meeting, which in the words of Mr. Margonlis, supplemented and summarized our knowledge of aerodynamics at high speeds. Chapter I is devoted to projectiles, early experimental and theoretical research with round balls, cylindrical bullets (flat or spherical head) pointed (circular arc) head, present status of the theory of projectiles' resistence. Chapter II treats the subject of wings; Part 1, subsonic speeds: Bernoulli's formula—critical point of zero speed, inclined plane — works of Tchapliguine, airfoils—flow with circulation — Glauert's formula, cylinder — Rayleigh's formula — flow in pipes, cylinder—conditions of speed of sound—experimental verification—airfoils—conditions of speed of sound — experimental verification, airfoils — calculated and measured values of lift, airfoils—drag and form coefficients. Part 2, supersonic speeds, shock waves and compressibility burble—general diagram, airfoil lift and drag—approximate solution, profiles composed of straight lines—rigorous solution. Chapter III is devoted to propellers: Part 1—cavitation of propellers, Part 2—adaptation of propellers to ultra high speed aircraft. Chapter IV describes briefly some of the existing high speed wind tunnels devoted to supersonic research. The last chapter presents the subject of heat and friction transfer in compressible fluids under high speed conditions.

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*Profile Drag, Professor B. Melvill Jones, A.F.C., M.A., F.R. Ae. S., The Royal Aeronautical Society*

The increasing understanding of the true source of profile drag is bringing a realization of possible considerable reduction of drag if airflow could be prevented from becoming turbulent. Prof. Jones gives a popular explanation of the phenomena involved, discussing the boundary layer, its laminar and turbulent condition, the viscous sub-layer and the point of transition from laminar to turbulent flow. He then describes the tests which were conducted by the Cambridge group to determine the profile drag by wake exploration in flight following a method suggested by Betz. These tests indicated the important magnitude of skin friction and possible gains in drag by careful treatment of wing surface. This paper summarizes simply but ably an important phase of modern aerodynamics.

## Electrical Welding

*Spot and Continuous Electrical Welding of Light Alloys and Its Application in Aeronautical Constructions (La Soudure Electrique dd Métaux Légers, par Points et á la Molette, et son Application dans la Construction Aéronautique; Ivan Nicolas Barrelon; L'Aéronautique, No.* 211; *Nov.* 1936)

In this article the author presents the technical and economic advantages of electrical welding, warns of the difficulties encountered in connection with spot and continuous welding and suggests means to overcome them. He describes a new process called "Electal" for welding light alloys. After reviewing the results obtained by using this method for different alloys he examines its application to aircraft construction. The article furnishes data for calculation and design for welded joints of light alloys.

## Engines

*Modern Engine-Propeller Group (Le Groupe Motopropulseur Moderne. Michael Precoul, Ingenieur Civil de L'Aéronautique; Revue du Ministère de l'Air; No.* 24, *Décembre* 1936)

The subject of the power plant and its functioning at altitude has become of particular significance in view of the general tendency to accept high altitude flying as a fact of imminent future. The first part of the article presents a mathematical analysis of the means for supercharging. It analyzes and compares centrifugal blower, turbo supercharger and Roots type superchargers. Theory favors the first two types. The second part of the paper is devoted to Diesel type engines giving a comprehensive review of the present state of development, mechanics of the engine and future possibilities of this type. In addition to the study of the influence of supercharging on the power variations with altitude and engine performance, the author describes in detail various essential parts of the modern engine. The third part which is yet to appear will cover carburation.

## Structures

*Tension Diagonal Fields; The Effect of Boom End Load on Tension Diagonal Field Distribution. E. H. Atkin, B. Sc.; Aircraft Engineering; Vol. IX, No.* 95, *January* 1937

After presenting a mathematical solution of the problem the author calculates certain curves for rapid determination of maximum intensity in any known average tension diagonal or semi-tension diagonal field. The curves are also used for the calculation of the maximum bending moment in the flanges bounding such a field. In the construction of these curves it is assumed that the end loads in the flanges are so small that there is no interaction effect between the end load and the bending moment analogous to "Berry" effect. The following conclusions are given in the article: (a) where the end loads are considerable these curves require modification which were included in the article; (b) the percentage variation from the "no end load" case is not great; (c) it is extremely pessimistic to use the unmodified "Berry Function" method; (d) the increase in accuracy obtained by the author's method is made uncertain because of uncertainty as to the degree to which any web is tension-diagonal, uncertainty as to the angle of the tension folds and, finally, uncertainty of the degree of interaction effect arising from pairs of flanges carrying end loads of opposite sign. The author points out that the value of the method lies in enabling the formation of picture of the behavior of the flanges and in showing that the Euler instability criteria has no meaning in the problem.

## Experimental Research

*New Methods of Mechanical Measurements (Nouvelle Methodes de Mesures Mechaniques, Andre Labarthe, Laboratoire de Mechanique Physique, Publication Scientifiques et Techniques du Ministere de l'Air, No.* 96, 1936)

This work will be found of great importance in connection with experimental engine research. It is hardly possible in so brief an extract to convey the completeness of the information gathered by Dr. Labarthe in this 268-pg. volume which has 283 illustrations. The subject of the paper deals mainly with measurements of instantaneous and mean pressures giving both theory and mechanical details of the various apparatus which, because of their recent appearance, are not widely known. The table of contents gives an idea of the broad scope of the book. Part One—Instantaneous measurements of variable pressures; historic and critical review of the methods employed; slow motor indicators, rapid motor indicators, optical indicators, stroboscopic indicators, electric indicators. Part Two—Photo-cathodic methods of pressure measurements; principle, electrical circuit, cathode type oscillograph, application of the method. Part Three —Maximum and mean pressure indicators; history and photocathode apparatus; the determination of the maximum pressure, determination of the mean pressure. Part Four—Torsiographs; historic and general revue; photocathodic type torsiograph.

## Elasticity

*Elastic Systems with Infinite Number of Elastic Restraints. (Sistemi Elastici con Infiniti Legami Sovrabbondanti. Carlo Minelli; L'Aerotecnica; Vol. XVI, No.* 11; *November* 1936)

The author recalls the Theorem of Least Work and gives its broader interpretation. He demonstrates how it can be applied to the problem of elastic systems with infinite number of elastic restraints by first arriving at the state deformation and then passing on to a determination of the stresses in the structure. To explain the use of the method an illustration is made of its application to a statically determined system. Later the method is applied to the case of a beam supported elastically by infinite number of cables and the case of reinforced cylinder under torsion. The article then presents more complex cases of the possible use of the method, a typical one being the problem of the wing with three beams subjected to simultaneous bending and torsion.




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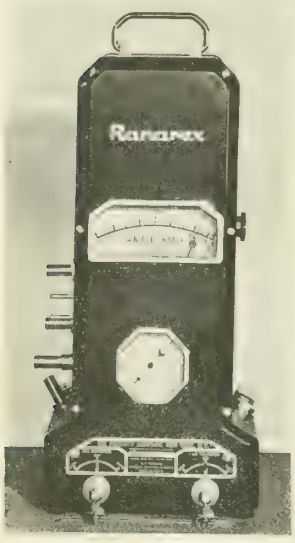
THE WACO AIRCRAFT COMPANY • TROY, OHIO

# EQUIPMENT and METHODS

## Exhaust Gas Analyzer

Of interest to maintenance and inspection personnel is the *Ranarex* exhaust gas analyzer introduced by the Permutit Co., because of the data it makes available on the operation of various types of internal combustion engines.

This instrument determines the air-fuel ratio by a mechanical principle based on the fact that the specific weight of exhaust gases varies with changes in the air-fuel ratio. To obtain substantial force as a means of measuring the specific weight of




the exhaust gas, a rotating motion is imparted to the gas by a motor-driven fan revolving in a chamber. This fan blows the gas against the blades of an impulse wheel, thus producing a torque on the shaft of the wheel in proportion to the air-fuel ratio. Changes in fan speed, temperature, humidity and atmospheric pressure are automatically compensated for by a comparing torque produced on another impulse wheel by air to which a rotating motion is imparted in a second chamber by a second fan driven by the same motor.

The two impulse wheel shafts are coupled together by a balancing linkage actuating the indicator, the scale being calibrated in terms of air-fuel ratio. A vacuum gauge built into the instrument permits measurement of the pressure in the intake manifold.

This exhaust gas analyzer is readily portable and can be furnished either with a motor for connection to the available standard lighting circuit or with a 6-volt dc motor which will operate at least 5 hrs. on one charging of a standard automobile battery.

## Stinson Reliant Wing Structure

The accompanying photograph of the metal wing structure now in use on Stinson *Reliant* planes shows the general manner in which these wings are constructed.

Due to the airfoil section and plan form of the wing, which is a Clark Y section, tapered and modified, each wing rib must be constructed in a separate jig. These ribs are built of square dural tubing, riveted together.

The Y, or inboard, section of the spar (fuel tank in middle of Y) is also built in a separate jig, as is the outer portion of the spar. These are constructed of chrome molybdenum steel. The false spar to the rear, together with the aileron and flap, are built of dural and are individually jigged so as to be interchangeable on any wing. Both sections of the spar, together with ribs, torque vees and false spar, are assembled in another jig.

The dural leading edge, steel wing tip, heavy gauge aluminum tank, cables and wiring, are installed after the wing has been removed from the assembly jig.

## 2000-Ton Metal Forming Press

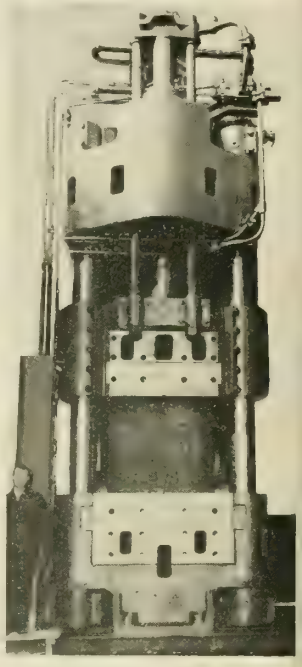
The 2000-ton hydraulic metal forming press installed in the Lockheed Aircraft Corp. factory is indicative of the tendency toward the use of larger and more powerful machines to meet the expanding production requirements of the aviation industry for the construction of large all-metal planes. This press is one of the largest so far built employing the modern, self-contained, oil power unit and is the largest of its type in use in the industry.

It stands nearly 26 ft. high, weighs 175 tons and was built by Farrel-Birmingham Co., Inc., for the Lockheed company for blanking and forming duralumin aircraft parts.

The press exerts a maximum pressure of 2000 tons under a hydraulic pressure of 2300 lbs./sq.in. on one 38″ ram and two 20″ rams. While the maximum capacity of the press is 2000 tons, the pump control is of such design that a wide range of hydraulic pressures may be obtained by a simple adjustment of pump controls, thereby varying the capacity of the press, as expressed in tonnage, in direct proportion to the hydraulic pressure. Provision is also made for using the central 38″ ram only, giving a capacity of 1300 tons. Two 10″ diameter, single acting push-back rams raise the moving platen to open position.

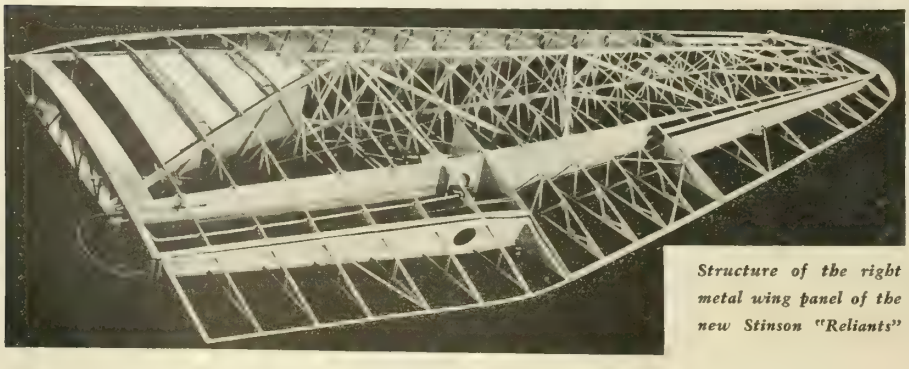
The press is designed with a maximum opening of 60″ and a maximum stroke of 36″. Closing speed is 130″/min. with a pressing speed of from 1″-10″/min. The traverse, or return speed is approximately 130″/min.

Power generating equipment consists of a motor driven pump, valves, piping and oil storage tank, mounted on top of the press. The hydraulic pressure pump is the radial piston type, with vari-



able pressure control and is driven by a 100 hp, 585 rpm squirrel cage motor.

Control of the press is effected from a control station located near a corner of the press and consists of a hand lever to control the movements of the hydraulically controlled operating valve, a push button for starting or stopping the motor and two gauges to indicate pressure on the rams.



*Structure of the right metal wing panel of the new Stinson "Reliants"*

## Fire Systems of Lighter Weight

Walter Kidde & Co., Inc., has developed a new improved valve for *Lux* airplane fire extinguishing systems which allows a weight reduction of approximately 12%. On single engine local control installations overall weight has been brought down to slightly under 15 lbs. Remote control and multi-engine installations have been correspondingly reduced in overall weight.

(*Continued on following page*)

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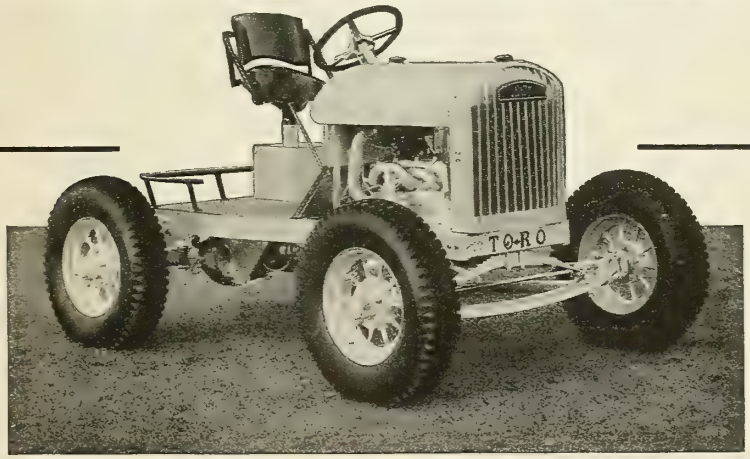
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(*Continued from preceding page*)

## Engine Testing Instrument Panel

An elaborate instrument panel test desk has been devised by United Air Lines engineers to feel the "pulse" of the two 1150 hp engines on United's new Douglas Mainliners. The instrument panel, installed in the cabin of the planes for tests conducted by United, Pratt and Whitney and Hamilton Standard Propeller to determine the best propeller and engine combination, was particularly intricate due to the fourteen cylinders on the twin-row Wasp engines that power the ship.

An engineer, seated at the desk, is able to take temperatures simultaneously at a large number of vital engine points that otherwise would be inaccessible. H. O. West, United's superintendent of maintenance, who took an active part in the preliminary engine tests points out that the panel supplements the instruments in the pilot's cockpit.

The principal instrument is a thermocouple type thermometer from which readings are taken from 22 different points, such as cylinder heads, spark plug gaskets, carburetor air, oil temperature, oil in and out of the supply tank, oil into the cooler, blower temperature and temperatures at several other points of the oil cooler.

Other instruments used in the collection of this engineering data include oil pressure, pressure at front and rear of engine baffle plates, altitude and pressure below the carburetor. The layout was used for more than 50 hours in flight tests on the west coast and at Hartford, Conn., where a ship was tested to ascertain that the engine installation was such to maintain proper operating temperatures under all operating conditions.

Another instrument which was used in these initial tests with the Mainliners was the Bowser fuel consumer-meter for determining fuel consumption at various altitudes and powers. The tests included full power flight, full load take-off, climbs at maximum power and single-engined climb.

## Screw Machine Feed Fingers

A line of universal feed fingers known as Type K, for feeding stock on automatic screw machines has been developed by the Eastern Machine Screw Corp.



The fingers are designed and proportioned for the size of stock they are to feed rather than for the size of machine. This assures uniform gripping pressure.

Inexpensive adapters are provided to fit the different sizes and makes of feed tubes and give the proper overall length for each machine.

## Map Making Equipment

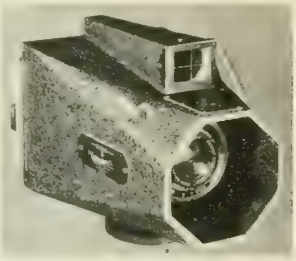
In conjunction with aerial photography of territory from which data on erosion is being secured for soil conservation work by the Department of Agriculture, the Spencer Lens Co. of Buffalo has designed and built a battery of projectors which brings photographs to the correct size for map makers.

These projectors have adjustments so that an image of a 10-in. photograph can be projected on the drafting board enlarged to 25 in. or reduced to 4 in. to fit the scale of the complete map. Adjustments for position also are provided. In addition to the projection of photographs, these instruments will also project photographic prints, drawings, sketches, charts, manuscripts, textiles or printed material. A blast of air sent into the light chamber by a motor driven fan keeps the object being projected cool.

## Aerial Camera

Skyview Camera Co. has completed the Model D, an aerial camera fitted for work in the air and on the ground. Although in appearance similar to the Model A Skyview, Model D is slightly larger and has new details, featuring foremost versatility.

With this focusing type camera, critically sharp negatives are made as close as 5 ft. Varying shutter speeds and a simple focusing arrangement make the camera capable of doing a variety of work. For air work, the focusing mechanism automatically locks in place when set and remains so until released by hand.



New features include a Zeiss Tessar F/4.5, 15 cm. lens, and the Compur shutter with automatically timed speeds, ranging from 1 sec. to 1/200 sec., including bulb and time exposures.

The Model D is designed with the interchangeable back, which permits the use of filmpack, roll film, cut film, or plates. Picture size is the standard 3¼ x 4¼.

The direct vision brilliant view finder is cross-hair etched on the finder element to facilitate proper centering and aligning of vertical and horizontal lines. A marker on the side of the finder element indicates the correction for parallax for use in close-up work. Length of the camera with the pack adapter, is 9" and weight, 5 lbs.-9 oz.

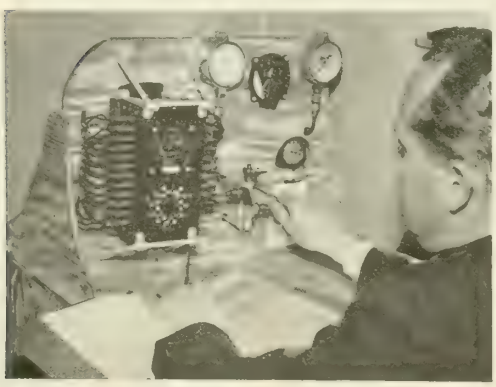
## Illuminated Wind Tee

A neon-lighted wind tee which under average conditions is visible from 3 to 5 miles and in foggy weather from 1 to 2 miles has been installed at Boeing Field, Seattle. Known as the Kirsten Hi Tensity wind tee, this device is illuminated by a hot cathode mercury vapor tube which consumes about 25 watts per lineal foot.

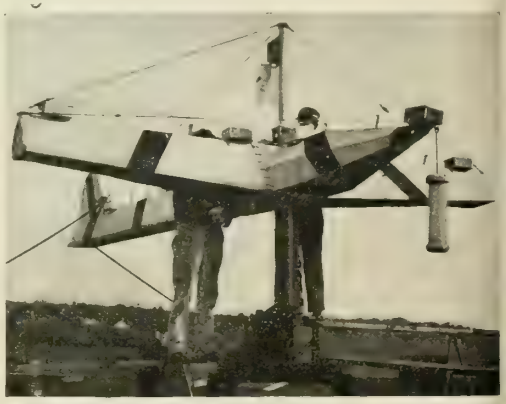
The tee is in the form of an airplane, being 18 ft. long and 12 ft. wide. It is mounted atop the administration building and is so constructed that it automatically swings on its base.

The tube is a new development in the field of tube illumination and is the result of design by Prof. F. K. Kirsten and the research laboratory of Electrical Products Consolidated of Seattle, which holds patents on the unit in conjunction with the General Electric Co. It has been photometered and showed 37.5 times brighter than ordinary conventional neon tubing.

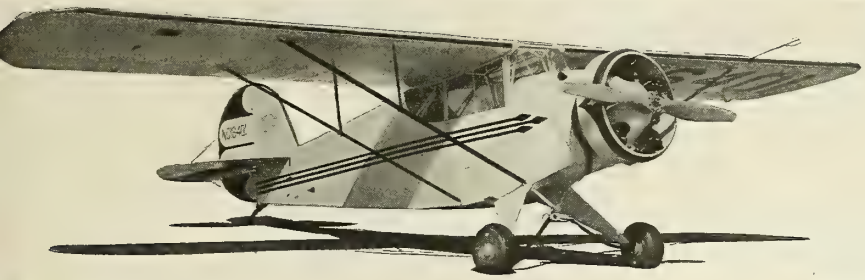
Ground tests have indicated that the new tube penetrates fog to a greater degree than other lights and it has been reported by pilots that it could be seen from an altitude of 20,000 ft. under ordinary flying conditions.



*Left: Instrument panel for testing the engines on United's Douglas "Mainliners"*



*Right: Kirsten Hi Tensity lighted wind tee installed at Boeing Field, Seattle, Wash.*



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*That's why three-quarters of the airports in America . . . and most of the planes using them . . . depend on RCA for radio!*

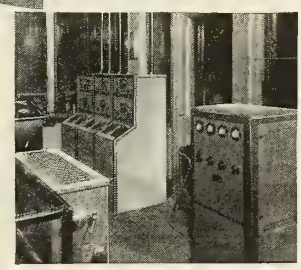
A moment before the take-off . . . the plane's motor has warmed up. And as the pilot prepares to take-off, he *knows* he has clear flying ahead. For his plane is equipped with RCA Aviation radio products—products that have his confidence!

Radio instruments of every type are built by RCA for aviation use. And proof that airmen trust in them for flying safety and convenience is indicated in the fact that 3 out of every 4 American airports—plus the majority of the planes that use them—own equipment bearing the RCA trademark!

Why not follow the example of your fellow aviators—and make *your own* aviation radio RCA ALL THE WAY? It's the smart, modern thing to do! It gives you the benefits of the very finest in aviation radio apparatus. And it costs surprisingly little! Ask for free information about the new RCA Radio Compass for planes, several types of Airport and Aircraft transmitters and receivers!



Just before take-off from Allegheny County Airport! Stinson Reliant, owned and operated by Gulf Refining Co. of Pittsburgh, Pa., is equipped with RCA Model AVR-7A receiver!



Allegheny Co. Airport, Pittsburgh, Pa., uses 5 RCA AVR-11 Airport receivers, each with an AVA-8 Crystal Control attachment. All are mounted in RCA MI-5747 Airport Traffic Control Tower Rack Cabinets. Also shown is RCA AVT-1A Airport Traffic Control Transmitter. Airport also has RCA AVT-1 Transmitter.

RCA *for Aviation Radio*

A SERVICE OF THE RADIO CORPORATION OF AMERICA

*RCA Aviation Radio Instruments are sold by* AIR ASSOCIATES, INC., Glendale, Cal.; Chicago, Ill.; Garden City, L. I.; or write direct to Aviation Radio Section, RCA Mfg. Co., Inc., Camden, N. J.

# Personalities

by Caldwell

● Ed Hedeen, whom you can take Steve Hay's word for it is the most experienced flying instructor in the Middle West, with 5,500 hours, 3,000 of it instruction, and the only surviving member of the Waco stunting team at the 1929 National Air Races at Cleveland, was born May 25th, 1895, at Dalbo, Minnesota. Ay tank he ban Swedish, like Great Garbo. Officially he's an American, but here's practically no difference between Minnesota and Sweden—it's looked upon as Swedish mandated territory by the League of Nations. Nobody's ever discovered why all the Swedes went to Minnesota, or why all Greeks who come here open restaurants, or why all Chinese start laundries and chop suey



*Eddie Hedeen*

places, or why so many visiting Englishmen have been seen scurrying around American airplane and engine factories during the past year. Such things are national mysteries, like hash or Chuck Kerwood, or why M. K. Lee sends everyone birthday cards, when nobody ever sends him any on *his* birthday . . . M. K. is the only living survivor of my Era, and every 13 of January he maliciously sends me a birthday greeting,—to remind me that I'm a whole year older and more horrible looking.

Ed Hedeen won undying fame (Steve Hay still remembers it, anyhow) by making 333 consecutive barrel-rolls in 3 hours 11 minutes on Armistice Day, 1928. Why he did it is another of our mysteries, like people who have never been in Sweden saying "Skoal!" to each other. Hedeen speaks, reads, and writes Swedish in seven dialects—they tell me at least six are needed in order to make yourself understood in all parts of Minnesota. He also speaks Danish and Norwegian, and when pushed to it, English. He doesn't say much in any language, however—you know what strong silent men those Swedes are.

### The Farmer's Son

Ed's father was a small-town merchant, but in 1902 he gave it up and went to farming because it was easier to be a farmer and get stuff from small-town merchants than it was to be a small-town merchant and get anything out of the farmers. Ed went through high school, took a couple of years at Dunwoody Institute, worked at farming, saw there was nothing in it, so went into logging camps in Northern Minnesota and chopped down trees until 1917 when he enlisted in the United States Navy. That was in Minneapolis, where the Navy enlisted 127 men as expert mechanics or electricians for the aviation service. Upon the group's arrival at Pensacola the Navy was mean enough to hold an examination, upon which it developed that only 17 knew a monkey wrench from a spark plug, so the other 110 went to sea on various boats, scrubbing decks, chipping paint, and other jolly tasks. Ed served his entire time there as Aviation Chief Machinist's Mate, learned to fly, ignored the silly old war entirely, and went back to Sweden—I mean Minnesota—in June, 1919.

That's the only sensible way to spend a war— in Pensacola with the pelicans. That's where the whole Navy will probably spend the next war, so when the battle wagons are sunk we'll know where to find them and haul them up again when the war is over. Which reminds me that the President in his infinite wisdom, has recently authorized the construction of two new battleships at an estimated cost of a hundred million dollars for the pair. The only thing he forgot to order was some device for keeping the things afloat if an enemy bomber wanted to send them to the bottom. Admiral Sims said the only safe place for a battleship in the next war will be as far up the Mississippi as it can push itself. Buying in quantities, which is the way we never buy airplanes, we ought to get about 2000 bombers for $100,000,000. Or say we bought big ones and only got a thousand. Is it possible that 1000 bombers would fail to sink 2 battleships? Could 100 fail to do the trick? Could 50? And how could 2 battleships stop an enemy air force from bombing Washington? We are building these 2 sinkers for "defense", mind you! Did any battleships defend London from the *Gothas?* It's a screwy world, mates—yo-ho-ho, and a bottle of bilge-water.

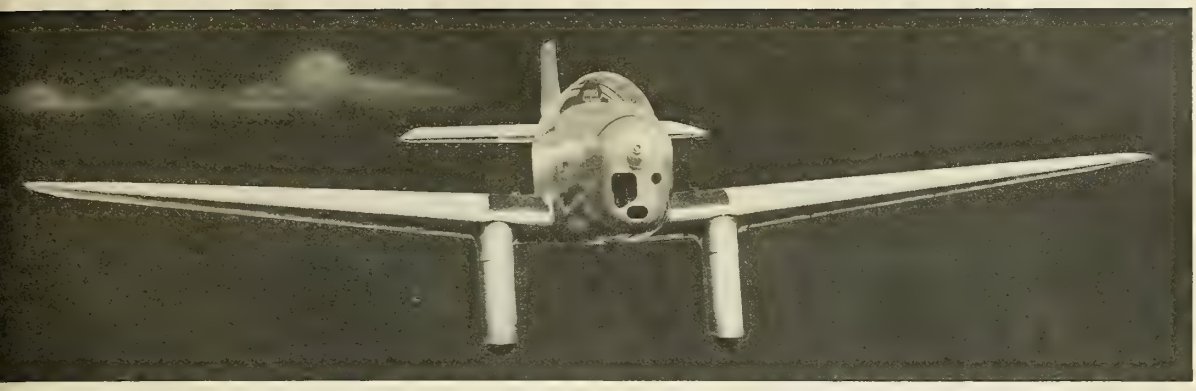
### "Hungry Annie"

Hedeen, ex-seaman,—he once went for a ride in that Pensacola crash boat, *Hungry Annie,* I think they called her—returned to Minnesota and barnstormed through that territory, the Dakotas and Wisconsin in the usual Jennies and Canucks until 1923, when he entered the Navy Aviation Reserve Service as Chief M.M. for three years, resigning to open a flying school at Waukegan, Ill. His equipment was one lordly OX-5 Swallow. Next year he moved to Racine, Wis. to take charge of the Air City Airport, which he still operates, and where he would be happy to receive letters from Scandinavian readers of AERO DIGEST—I think we have a man in Sweden who is reading it during the long winter nights,—that is, if he hasn't given up and emigrated to Minnesota, on account of being lonesome living all alone in Sweden. Hedeen has flown in about every state in the Union (are Maine and Vermont still in the Union, or have they seceded?) He has flown in Canada and Mexico, wandered all over, but for the past four years has tamed down and instructs at Racine, Wis. and is Aviation Instructor at the State Vocational School there.

He has four children, Marion, 18, Burt, 15, Julianne, 13, and Franklin, 11. He's teaching Marion and Burt to fly and believes that all American youth should be taught to fly as casually as to drive a car, Steve Hay says. If they fly as "casually" as most of them drive cars, that will be another headache for the Department of Commerce.

### "Tank Ay go home"

Life in Wisconsin growing slightly monotonous as it does in most places, Ed Hedeen enlisted the aid of some prominent Scandinavian Societies in the U.S. to promote a Goodwill Flight in a Lockheed Vega seaplane via Greenland to the Scandinavian countries. They were all glad to chip in to send him over to see if there were any Swedes left over there. Living in the Middle West naturally gives one the impression that Sweden must be empty. Ed couldn't get ready in time to make the flight in 1936 but hopes to make it in 1937. I certainly hope he picks his weather. There's a lot of water and a lot of weather between Canada and Greenland, Greenland and Iceland, and Iceland and the mainland. Now, if Dick Blythe was considering that flight I'd say, "Go ahead, Dick—it's what you ought to do." But in your case, Ed, I'm thinking of Marion, Burt, Julianne, and Franklin. I'm thinking of those 333 barrel-rolls, too. Maybe they sorta unsettled you, somehow.



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Chicago June 12 / 20 1937

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# DIGEST OF THE NEWS

●

## SCHOOLS

### Enrollments

Lyon Air Services enrolled six new students during March and made more than 65 flights in their new Ryan S-T.

* * *

Fifty-five students from 17 states, Alaska, Canada, and Australia were represented in the winter enrollment at the Boeing School of Aeronautics, Oakland, Calif.

### New Courses

Robertson Aviation School, located on Lambert Field, is offering a nine-month radio course. Joseph W. Wecker, Manager of the School, also announced extension of the present six-month airplane and airplane engine mechanics courses to be extended to nine months, and of the six-month night mechanic course to 12 months. Total present enrollment is 103 students.

* * *

Ground schools at Utica and Elmira, New York, are maintained as a part of the Emergency Adult Education Program. These schools are planned primarily for young men who wish to enter the aviation industry. The course of study covers 2000 hours and may be completed within a year. Schools are in session from Monday to Friday, inclusive, from 8 o'clock in the morning until 4:40 o'clock in the afternoon. One hour each day is devoted to lecture work and the remainder of the time is spent in shopwork, including the repairing of airplanes, engines, etc. Subjects covered include airplane engines, airplanes, aircraft welding, sheet metal work, radio and some work in navigation and meteorology.

* * *

Night classes in ground work have been started by Portland Flying Service, Inc., Portland, Me., with John V. Lamarche, Jr. as instructor. Classes are held twice a week. Lamarche also is in charge of general sales for the company which is dealer for Stinson aircraft.

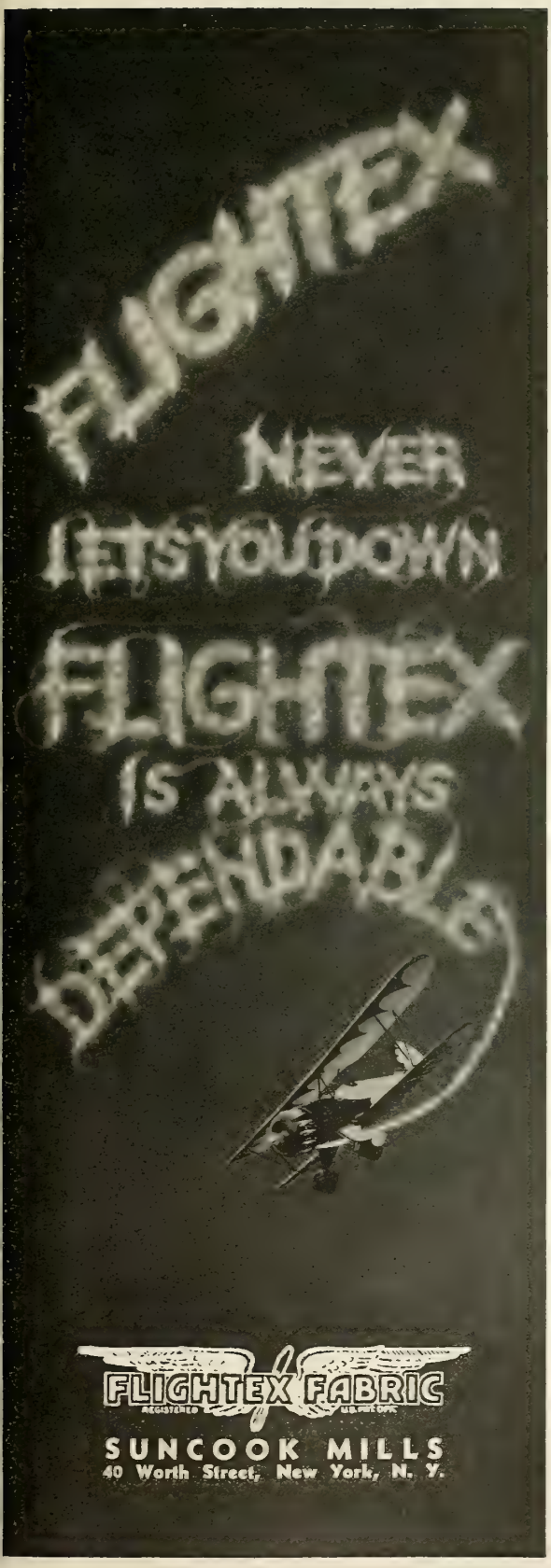
* * *

A complete ground school course, available to Battle Creek, Mich., residents without cost, started Feb. 8 at the W. K. Kellogg Airport with Keith Moon, airport manager, acting as instructor. Classes are held one

(*Continued on following page*)

***One of the Link Trainers just purchased by American Airlines for instruction in instrument flying***






# MORE

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Forty-three types of FAHLIN PROPELLERS are approved by the Department of Commerce, for use with engines indicated below in the new price list which is effective April 1.

For Continental A40 and A40-4—Aeronca E113 and E107..... $31.00

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For Warner Junior—Warner Scarab—Warner 125 h.p.—Warner Super Scarab—Warner Super Scarab (Cessna)—Tank—Menasco 125 h.p.—Kinner B5—Kinner K5—Genet—Ford V8 (Arrow)—OX5 and OXX6..... $46.50

For Menasco 150 h.p. (Ryan)—Jacobs 225 h.p.—Continental A70 and Continental R670... $56.00

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FLAGSHIP
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WEATHERHEAD Parts for AVIATION
ALUMINUM FITTINGS • HYDRAULIC BRAKE HOSE
VACUUM, OIL PRESSURE, GYROSCOPE HOSE

(*Continued from preceding page*)
night each week and will continue for about eight months. Courses include air traffic regulations, engines, aerodynamics, theory of flight, meteorology and aircraft construction.

### New Equipment

Several thousand dollars worth of radio equipment, including transmitter, receiver, cathode ray oscillograph, code instruction machine, public address system, all wave oscillator and frequency monitor have been installed in the radio building at Parks Air College for use of students enrolled in the new aircraft communications course.

* * *

A new teletype has been installed in the meteorology laboratory at the Boeing School of Aeronautics, Oakland Municipal Airport, for the training of students in securing and studying airway weather information.

### Scholarship Committee

Winners of the Boeing School of Aeronautics 1937 W. E. Boeing Scholarships will be determined by a Committee of Award which will convene at the school offices at Oakland Municipal Airport to examine and judge the merits of entries which have been received from students throughout the United States.

This represents the eighth year these scholarships have been awarded, and the 1937 awards represent a total tuition value of more than $11,000.

The following have been invited to serve on the Committee: Dr. Baldwin M. Woods, Head of the Mechanical Engineering Department, University of California, as Chairman; William B. Stout, Stout Engineering Laboratories, Dearborn, Mich., and Prof. Frank Hockema, Purdue. Dr. Jerome C. Hunsaker, Head of the Department of Mechanical Engineering at M.I.T., has been asked to nominate one member.

## PRIVATE FLYING

### Clubs

Aircraftsmans Association of Pennsylvania has been formed with a charter membership of 30, every one of whom is a licensed aircraft and engine mechanic or interested in aviation. Facilities include a shop and club room and the organization aims to aid the mechanic to obtain a position in the industry. Outside repair and service work is done and evenings are spent in the shop where members brush up on all phases of their work. Officers are J. L. Hainsworth, president; W. S. Campbell, vice-president; B. A. Humphreys, treasurer; and E. Carlson, treasurer.

* * *

Membership of the South Bend Pilots Club is still increasing and with the recent addition of three new men the total is now 90. Phillip Wilber, Chas. Selge, and H. L. Stewart, president of Arup Manufacturing Co., are among the new members.

### Air Races

The St. Louis Air Race Association will on May 29 to 31 bring to St. Louis its first air races on a national scale since 1923. A guaranty fund of $65,000 had been raised on March 10. A total of $15,500 in prizes will be offered to race winners.

Facilities will be provided at the St. Louis Municipal-Lambert Airport for 15,000 spectators daily. The races will be held over a five-mile course of three legs. George B. Logan is chairman of the race association. James R. Ewing who will manage the air races has set up an office in the Mayfair Hotel, St. Louis.

A national aerobatics championship to determine leading professional stunt flyers will be held during the three days of the meet.

* * *

Stunt flying by Lieut. Joe Mackey, winner of the 1936 Freddie Lund trophy awarded yearly at the Miami-All-American Air Maneuvers for precision aerobatics featured a two-hour air show program that attracted more than 10,000 persons to the new $175,000 West Palm Beach, Fla., municipal airport. The event marked the dedication of the recently completed airport. Bill Sweet announced the program over the Columbia network. Among the aeronautical personalities present for the program were Capt. Alex Papana, Don Flower, of the Waco company, Major Hugh Watson, Ike Vermilya, Capt. Richard Merrill, R. J. Walters, Bert Shoemaker and R. V. Waters.

### Air Marking

The Bureau of Air Commerce announced the progress of its nationwide system of air marking towns and cities. Of Government sponsored air markings, some 10,000 are either completed or under construction.

Aside from the towns which the Government through appropriation was able to assist in this undertaking, various civic organizations have assisted the Federal Government in its plan to have every town and city adequately air marked. Among these are the Exchange Club, the Rotary Club, the Kiwanis Club, the Chambers of Commerce and



*Stearman-Hammond Model Y ready for its test flight after coming off the production line*

many other local organizations, as well as civic authorities.

## AIRPORTS

### More Hangars

During the past year, according to a report of Michigan Bureau of Aeronautics, hangars were completed in 13 Michigan cities.

Three cities, Marshall, Marquette, and Muskegon built hangars 100 × 100 ft. Rogers City, Alpena, Sault Ste. Marie, Holland, Petoskey, and Crystal Falls got hangars 60 × 40 ft., while 80 × 60 ft. hangars were built in Lansing, Ionia and Traverse City. A 100 × 80 ft. hangar was built at Jackson.

### Airplane Display

H. C. Robbins Co., Waco distributor for Northern Ohio, will show the new line of 1937 Wacos in its hangar at Cleveland Airport, the display being open to the public on April 24 and 25. Fully-equipped C-7 and S-7 Waco Cabins, just delivered from the factory, will be on display.

In addition to Wacos, the company is distributor for Jacobs and Continental engines and Skyview Cameras. The showing this month will include exhibits of all of these, as well as Edo Floats, Curtiss Reed Propellers, Champion Spark Plugs and other accessories.

### Newspaper Delivery

Year-round airplane delivery of newspapers to Block Island residents off-shore in New England was inaugurated February 21, by Ralph Bourdon, chief pilot of E. W. Wiggins Airways, Rhode Island State Airport.

In the past, the *Journal* has been delivered by air to Block Islanders only in the Summer, when there are many seasonal visitors at the resort. The new service is intended to be maintained the year 'round and Bourdon estimated that with ordinary weather expectations he would be able to complete the trip 90% of schedule. Ordinarily delivery is made by boat.

The new service flown in a Stinson *Reliant* will put the Providence papers in the hands of Block Island patrons at approximately 9 a.m. every Sunday, instead of 1 p.m., or later, which is the normal time of arrival of the boat.

### Activity

According to W. L. Williams, supervisor, activity of Love Field, Dallas nearly doubled during February over January. All airlines reported gains as well as sight-seeing concerns. There were 489 commercial transport planes in and out of the airport during the month as compared with only 282 in January when inclement weather cut into operations. The figure for February is practically the same as February, 1936, when there were 491 planes in and out. There were 1890 passengers in and 1898 out during February this year as compared to 1412 in and 1559 out last year. There were only 919 in and 929 out in January. Transient planes also showed an increase for February. There were 260 arrivals at the field as compared with 150 in January and 200 for February last year. Sight-seeing planes did a good business during February in taking 312 passengers on 113 flights as compared with only ten flights in February, 1936. There were fifty-one flights in January carrying ninety passengers. Free flights in February, 1937, amounted to 419 with 308 passengers.

## AIRLINES

### Mail Extension

Trans-Pacific air mail service will on April 21 be extended from Manila to Macao, (near the China coast) and to Hong Kong, where connections will be made with airline services in China and airline services to Australia and India and intermediate points.

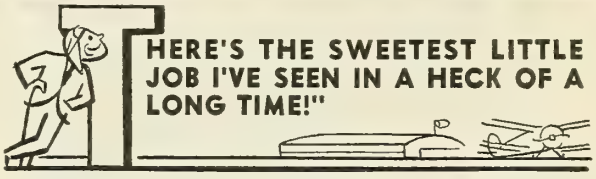
### Re-equipment

A new fleet of Boeing transports is now in operation on all scheduled flights on the Pennsylvania-Central Airlines route between Washington, Pittsburgh, Akron, Cleveland and Detroit. The new 247D Boeings are almost 20 miles per hour faster than those previously operated by PCA and are completely soundproofed.

(*Continued on following page*)







**"HERE'S THE SWEETEST LITTLE JOB I'VE SEEN IN A HECK OF A LONG TIME!"**

**"YEAH MAN . . . AND SHE CAN PARK HERSELF IN MY HANGAR ANY OLE TIME!"**



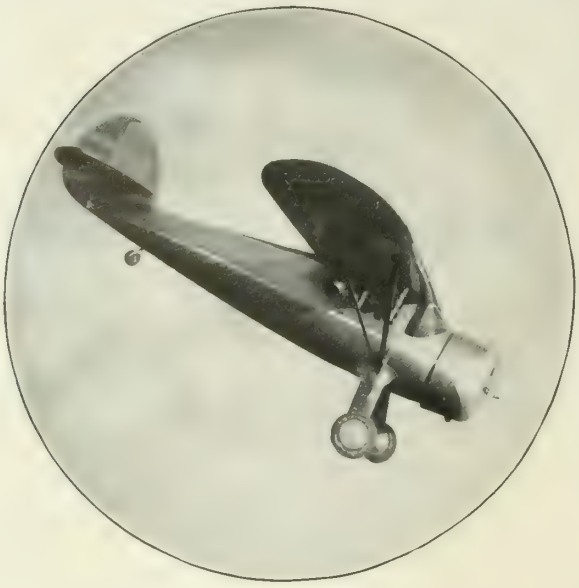
You can't blame these fellows for their words of admiration. This spectacular new 1937 Aeronca has what it takes to catch the eye of any flying man! ▸ You can thank Sherwin-Williams Airplane finishes for a big part in the Aeronca's smart good looks. They keep these handsome ships sleek, well-groomed and colorful through months of use. ▸ And it's a beauty more than fabric-deep. Sherwin-Williams Airplane Finishes add safety and speed to any plane by keeping wings and fuselage smooth and taut through heat and cold, wet and dry weather. They stand up . . . protect and preserve. And they do all this with a real economy important to makers of planes big and little. ▸ Full details about these highest quality airplane finishes are yours for the asking. Write the Aeronautical Division of The Sherwin-Williams Company, Cleveland, Ohio.

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**It is designed and built to the higher standards best appreciated by the market which is airplane wise.**

**Our production capacity will now permit additional dealer contracts for the new Phantom and other metal airplanes shortly to be announced.**

**As an airplane owner you will want the fire resistance and strength of metal construction—as a dealer your future is best associated with a product leading the field in advanced construction.**

*For information address inquiries to:*

**LUSCOMBE AIRPLANE CORPORATION**

**WEST TRENTON, N. J.**

(*Continued from preceding page*)

Powered by supercharged Wasp engines, providing a total of 1500 hp, these ships cruise at 189 mph and it is planned to also put the Boeings in operation on the Detroit - Milwaukee and Detroit - Flint routes at an early date.

* * *

Faster service across the country in the new TWA Luxury Sky Sleepers will be inaugurated May 15, according to John B. Walker, traffic vice-president, following test flight figures of the new Douglas transports.

Performance figures of the new plane showed that speed, fully loaded to 24,800 lbs., is 218 mph, and with one engine, 128 mph at 8500 ft. Absolute ceiling is 24,000 ft. and on one engine with normal operating load, ceiling is 10,500 ft.

Flight test figures showed 1100 rated hp each for the two new Wright Cyclone engines which have a 1205 take-off hp.

Other performance figures show a landing speed of 64 mph; climb of 1050 ft./min. at sea level; a take-off distance of 900 ft.; and a landing distance of 1640 ft. On one engine, climb rate is 375 ft.

* * *

Fast coast-to-coast schedules will be inaugurated this month by United Air Lines when it starts a three-stop 14 hr. 20 min. service from California to New York and a two-stop 10 hr. schedule from California to Chicago, with introduction of its Douglas Mainliners.

In addition, United starts coast-wise flights April 15 with Mainliners between Seattle and Los Angeles, with stops at Portland and San Francisco, and placed a fifth round-trip Mainliner schedule on the Chicago-New York route.

United will operate three Mainliner schedules from coast to coast within 30 days, supplemented with 10-passenger Boeing flights on inter-city service and to provide frequency of schedule.

* * *

C. R. Smith, president of American Airlines, Inc., has placed an order with the Douglas Aircraft Co. for 7 additional Flagships for delivery during the summer months. These new planes represent an investment of more than $750,000.

Three of the Flagships will be 21-passenger Club planes and four will be Sleepers. Delivery of these planes will bring American's Douglas fleet to a total of 52 planes, including 25 Club Flagships, 12 Sleeper Flagships and fifteen 14-passenger ships.

## Personnel Notes

Appointment of supervisory personnel to fill new positions in its Operations Department have been announced by C. Bedell Monro, president of Pennsylvania-Central Airlines. Under the new organization plan, J. H. Neale becomes Superintendent of Flight Operations; Luther Harris, Superintendent of Maintenance; W. R. Manchester, Superintendent of Ground Stations and Lloyd A. Sykes, Meteorolgist.

* * *

Kenneth M. Kinnie, formerly with Eastern Air Lines has become traffic representative of American Airlines at Detroit.

## Prerequisite

Scheduled airline aircraft will be required, beginning January 1, 1938, to carry approved radio direction finders provided with means for the elimination of interference from rain, snow, sleet, or dust static, and on November 1, 1937, these aircraft will be required to be equipped with an approved radio antenna system, also designed to eliminate static from rain, snow, sleet or dust. These requirements are contained in two amendments to the Air Commerce Regulations governing the operation of scheduled airline services.

## 1,147,969 Passengers

Airlines operated by American companies (domestic and foreign extensions) carried 1,147,969 passengers and 8,350,010 pounds of express during the calendar year 1936, according to the Bureau of Air Commerce.

Of the total number of passengers carried in 1936 there were 1,020,931 who travelled on the domestic lines and 127,038 who flew on extensions to foreign countries.

In 1935, American-operated airlines carried 860,761 passengers and 5,511,737 pounds of express.

Miles flown by all scheduled operators in 1936 were 73,303,836 as compared with 63,540,233 flown in 1935. Passenger miles flown in 1936 were 491,744,053 and for 1935 this figure was 360,569,431.

There were 380 airplanes in operation on the scheduled airlines at the end of the year. These aircraft consumed 37,057,069 gal. of gasoline and 871,663 gal. of oil. The airlines furnished employment for 9972 persons (as of December 31) classified as follows: 690 pilots, 543 co-pilots, 2864 mechanics and ground crew men, 1764 other hangar and field personnel, 3721 operations and office personnel, 287 hostesses, and 103 stewards.

* * *

Passenger traffic during January 1937 over 19 scheduled airlines operating in continental United States totaled 46,012. These lines flew 4,198,584 miles, carried 554,030 pounds of ex-

press, and flew 21,378,754 passenger miles during the month.

A comparison with January 1936 shows that express poundage increased from 354,301 to 554,030 and passengers from 44,061 to 46,012.

* * *

An increase of 71.7% in the number of air express shipments in and out of New York City for February 1937 over February of 1936 was announced by Railway Express Agency.

* * *

Carrying 15,929 passengers during February, American Airlines, Inc., showed an increase of 81.4% over the same month a year ago and 23.3% over January. During the month American also carried its 1,000,000th passenger, the first line in the world to pass this milestone.

* * *

Record increases in every branch of its operations made 1936 a banner year in its history, figures released by Eastern Air Lines through Capt. E. V. Rickenbacker, general manager, revealed. With 102,606 revenue passengers carried, the year saw an increase of 28% over 1935 figures. A total of 45,435,175 revenue seat miles were also flown during the year, Capt. Rickenbacker reported.

* * *

Greatest business in its history was enjoyed in 1936 by Transcontinental & Western Air, Inc., according to Jack Frye, president. About 23,000 more revenue passengers were transported in 1936 than in 1935, and revenue passenger miles flown increased by nearly 15 million. Mail pound miles jumped by more than 660 million while air express, operated by TWA's affiliate, General Air Express, increased by more than 135 million pound miles.

The actual number of revenue passengers transported in 1936 by TWA was 88,851, or better than 25% more than the 66,882 carried in 1935.

* * *

Northwest Airlines, Inc., carried 1,149,369 pounds of mail in 1936, 38,500 revenue passengers and 172,011 pounds of express in 1936, according to Croil Hunter, vice-president and general manager. This compares with 1935 figures of 648,492 pounds of mail, 25,123 passengers and 72,422 pounds of express. Revenue passenger miles flown in 1936 were 16,579,585, compared with 10,342,834 in 1935.

### New Services

Passenger, mail and express service from all parts of the United States to Europe will again be available this year through renewal of a contract between American Airlines, Inc., and the American Zeppelin Transport Corp., agents for Deutche Zeppelin Reederie, operators of the Zeppelin *Hindenburg*.

The airline again will operate between Newark, N. J., and Lakehurst connecting each arrival and departure of the dirigible with the nationwide net of airways, including the trans-pacific Clipper plane service. The *Hindenburg* is scheduled to make eighteen round trips to the United States during 1937, as against ten last year.

* * *

Atlanta and Gulf Coast Airline has instituted passenger and express services from Savannah, Ga., to Jacksonville, Tallahassee, Pensacola, Fla., and Mobile, Ala. Ships fly west bound on Monday, Wednesday and Friday. East bound ships leave on Tuesday, Thursday and Saturday.

H. G. Strachan, Jr., is president of the company; C. C. Wonycott, flight superintendent; and F. M. Papy, Jr., traffic manager.

* * *

Extension of Braniff Airlines into Mexico City will begin about June 1, according to Traffic Manager Charles Beard. At present the line ends at Brownsville, Tex., in the south and at Chicago in the north.

The extension will require new equipment to the line, and five Douglas airliners will be used.

* * *

Survey flights over a 7000-mile route projected across the South Pacific Ocean to link the United States, American Samoa and Australasia, were inaugurated from the base at San Francisco last month.

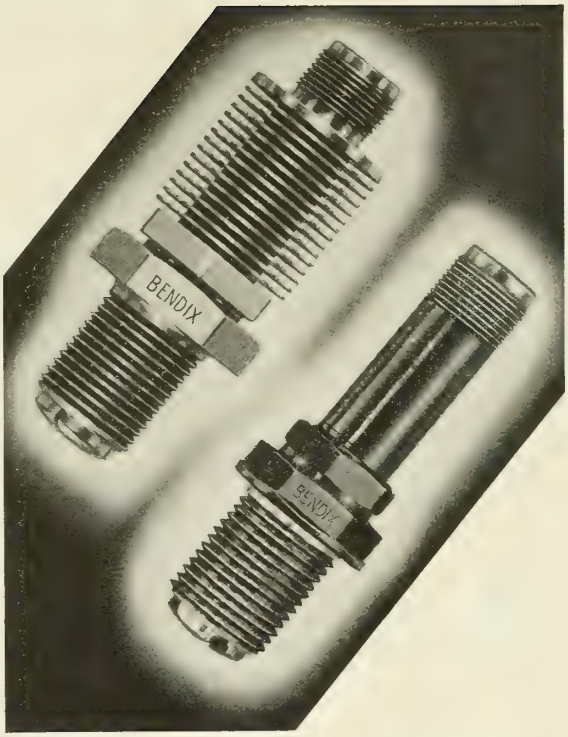
In preparation for the establishment of the South Pacific service, Pan American Airways has been conducting route research over this projected line since late in 1934. At present, three bases are equipped to function as complete operating points. For some time Pan American has had an experimental base force stationed at Pago Pago, American Samoa, including full operating equipment and staffed by an operations engineer, a radio operator and meteorologist. A similar station, with a similar staff and equipment, is established at Auckland.

## AIR SERVICES

### School Activities

During the calendar year 1936, a total of 83 officers and 281 Flying Cadets commenced training at the Air Corps Primary Flying School at Randolph Field, Texas. The March, 1936, class, the smallest entering the Air Corps

(*Continued on following page*)




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*Aircraft*

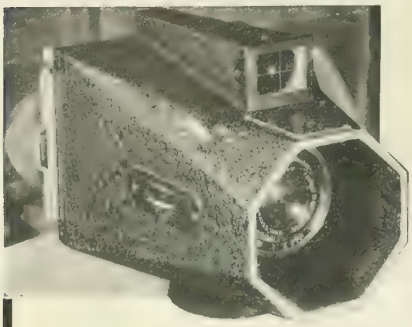
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*"The Drop-Forging People"*

New York BUFFALO Chicago

*(Continued from preceding page)*

Training Center for quite a number of years, comprised 7 officers and 61 Flying Cadets; the July class, 15 officers and 117 Flying Cadets, and the October class, 61 officers (all graduates of the June, 1936, class of the U. S. Military Academy) and 103 Flying Cadets.

A total of 196 students graduated from the Air Corps Advanced Flying School, Kelly Field, Texas, during 1936. The February graduating class comprised 5 officers of the Regular Army, 2 foreign officers and 45 Flying Cadets; the June class, 9 officers and 52 Flying Cadets, and the October class, 34 officers of the Regular Army, one officer of the Philippine Constabulary and 48 Flying Cadets.

Ten Air Corps officers were assigned as students in the 1936-37 class of the Army War College, and nine in the 1936-1937 class of the Army Industrial College.

Graduation Exercises at the Air Corps Tacticaly School, Maxwell Field, Ala., were held on June 2, 1936, the graduating class comprising 66 Air Corps officers, one Navy officer and three Marine Corps officers.

### More Aircraft

The War Department has purchased from Sikorsky Aircraft Division of the United Aircraft Corp., 5 amphibion planes and spare parts equivalent to one complete plane, for the sum of $633,898.

To adapt these planes for military purposes, the commercial design has been modified. Wing span is slightly in excess of 85 ft. and power is derived from two 750 hp P & W engines.

### Trophy Presentation

First presentation of the Rear Admiral William A. Moffett Memorial Trophy took place March 13, on board the U.S.S. *California*. The presentation was made by the Commander Battle Force, Admiral C. C. Bloch, U.S.N., to Lieutenant Robert F. Hickey, U.S.N., who was commanding officer of the *California* Aviation Unit of Observation Squadron 4, the winning unit.

The Rear Admiral William A. Moffett Memorial Trophy is awarded annually to the battleship or cruiser based aviation unit which conducts its operations throughout the year with the maximum safety.

### Cadet Vacancies

Vacancies again are open to New York, New Jersey, and Delaware youths as flying cadets at the Army Air Corps Training Center at Randolph Field according to Col. Frank P. Lahm, air officer of the Second Corps Area, Governors Island, New York.

Candidates for appointment must be citizens between 20 and 26 years of age and unmarried. Applicants who have not satisfactorily completed at least two years of standard college work must pass a written educational examination which is the equivalent thereof. A rigid physical examination must also be passed.

### New Building

An $18,000 glass-brick machine shop and instrument room is now being built as a facility of the Miller Aviation Field, New Dorp, Staten Island, N. Y.

The foundation has already been laid for the new unit which will measure 100′ × 20′, and will be located on the east side of the hangar. Built of glass bricks, the building will be without windows but assured of ample daylight.

## THE INDUSTRY

### Best Export Year

Showing an increase of 31.4% over the best previous year, and a gain of 60.9% over 1935, exports of aeronautical products from the United States in 1936 reached a total of $23,055,761. In dollar value this compares with $17,548,181 in 1934, the best previous year, and $14,330,843 in 1935. During the last three years, average unit export values of aircraft were $22,600; $19,876 and $16,854; for engines $5,711; $4,330; and $4,253.

The ten countries whose imports of American-made aeronautical products exceeded those of the other 74 countries represented by purchases in 1936 are as follows: China, $7,185,556; Argentina, $2,269,914; Netherlands, $1,108,335; Netherland India, $1,063,509; Japan, $989,100; Canada, $706,824; Mexico, $680,101; France, $675,546; Australia, $644,587; Yugoslavia, $641,403.

### 15,952 Pilots, 7424 Aircraft

There were 15,952 pilots and 7424 aircraft holding active Department of Commerce licenses on January 1, 1937, according to the Bureau of Air Commerce, Department of Commerce. On January 1, 1936 there were 14,805 licensed pilots and 7371 licensed aircraft.

The total number of aircraft licensed and unlicensed of which the Department had record on January 1, 1937 was 9229, while this number on the corresponding day of last year was 9072. Unlicensed aircraft (bearing identification numbers only) totaled 1805 on the first of January, 1937.

Pilots' licenses as of January

1, 1937, were divided into 7250 transport, 880 limited commercial, 7154 private and 668 amateur. Licensed pilots included 444 women of whom 71 had transport licenses; 23 limited commercial; 295 private; and 55 amateur.

### Expansion

Lockheed Aircraft Corp. has purchased its present factory and site together with several acres of adjacent property and is embarking upon a building program. A new assembly hangar, administration building, engineering department and several smaller structures are contemplated. A 23-ft. high hydraulic metal forming press has been installed and is housed in a new building.

* * *

Plans for immediate expansion of the North American Aviation, Inc., factory are being made. An increase of 125% of present ground floor area will immediately be undertaken. The new portions of the building will conform to the style of the original structure, being of steel, brick and concrete construction. The 240-ft. span within the building will be elongated into the new structure, thus anticipating the assembly of airplanes of large wing span.

* * *

New York zone office of Bendix Products Corp. formerly at 230 Park Avenue, has been moved to 420 Lexington Avenue, into larger quarters.

* * *

Purchase of a new factory site containing nearly 3 acres and a building having a capacity of more than 45,000 sq. ft. of floor space, was announced by Menasco Manufacturing Co. The new factory site is located in the immediate vicinity of the present Menasco plant.

The new building is of metal exterior and roofing, having a concrete floor throughout. Adaptions will be made in the rehabilitation of the property to suit the needs of the engine company. Administrative offices will be built into a new adjoining unit, according to present plans. All other departments, including the engineering quarters, will be located in the factory building. Test stands to accommodate the running-in and testing of the six different model engines manufactured under the company's present production, will be built on the property away from the plant building.

### Faster Beechcraft

Shown publicly for the first time at the Los Angeles aircraft show last month, the new D17W Beechcraft 5-place cabin plane powered by a P & W SC-G Wasp engine is expected to have a cruising speed in excess of 235 mph at 13,500 ft. using 365 hp.

Refinements in the new plane include a new wing section, cantilever tail group with increased and deeper section surface areas, balanced wing flaps attached to lower wings, improved shock absorption, enlarged and rearranged cabin and longer fuselage and set back tail wheel.

Span is 32 ft., overall length 26 ft. and height 8 ft.; wing loading 15.7 lbs./sq. ft.; power loading 7 lbs./hp.; and baggage 125 pounds. Empty weight is 2800 lbs., useful load 1400 lbs., and gross 4200 lbs. Tankage is provided for 120 gals. of fuel and 7.5 gals. of oil.

### Fagg New Air Head

With the resignation of Eugene Vidal and reorganization of the Bureau of Air Commerce under way, Secretary of Commerce Roper appointed Fred D. Fagg, Jr., as director, being assisted by Maj. R. W. Schroeder, chief of the airline inspection service.

Rex Martin, assistant director of the bureau in charge of navigation and Col. J. Carrol Cone, in charge of regulations, have been assigned to study missions in Latin America and Europe, respectively.

### 1000 HP Cannon Engine

Fairchild Engine & Airplane Corp. is now developing a 24-cylinder H-type engine delivering about 1000 hp and permitting the mounting of a rapid-firing cannon which will be restricted to military use only.

Four air-cooled banks of six-cylinders in-line are used, each

(*Continued on following page*)



***Wasp-powered D17W, newest 5-place Beechcraft***





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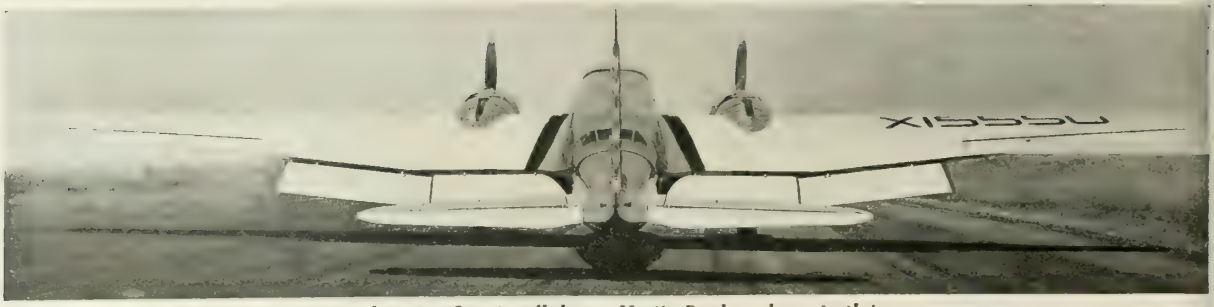
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SALZMAN AIRCRAFT SERVICE
City Airport Detroit, Michigan



*Fowler wing flaps installed on a Martin Bomber, shown in their extended position*

(*Continued from preceding page*)

unit being connected to a propeller shaft in the center of the assembly. The propeller shaft is hollowed out for the muzzle of a small cannon.

### Fowler Flaps

At the meeting conducted by the Society of Automotive Engineers in Washington, D. C., March 12, a paper was presented by Harlan D. Fowler, of the Glenn L. Martin Co. on *The Practical Application of Fowler Flaps*. This is a new development which has been undertaken by the Martin Company.

The flap has three advantages justifying its use on present day transports—first, it supplies a most efficient means for rapidly taking-off an airplane, whether it is a landplane or a seaplane; secondly, it develops normal flight characteristics when landing, due to its low drag properties; and thirdly, it has the ability to improve the rate of climb under certain partially extended conditions.

Emphasis was also placed upon its auxiliary function as a "spare wing," which should mark a distinct advance in providing additional safety. Particularly so in the case of ice formation on wings, partial engine failure and emergency landing conditions.

Reference was made to the practical application on a number of airplanes including a new type Martin Bomber. Fowler flaps also are being installed on the new Lockheed 14.

### Cub Output Continues

Production of Taylor Cubs at Bradford, Pa., is being pushed since the fire that almost totally destroyed the factory on March 16. A large proportion of the jigs and dies used in the manufacture of Cubs were saved.

Temporary quarters are being utilized by assigning foremen and their crews to available space in local buildings. Replacements of material and equipment lost in the fire are being rushed from all sections of the U. S.

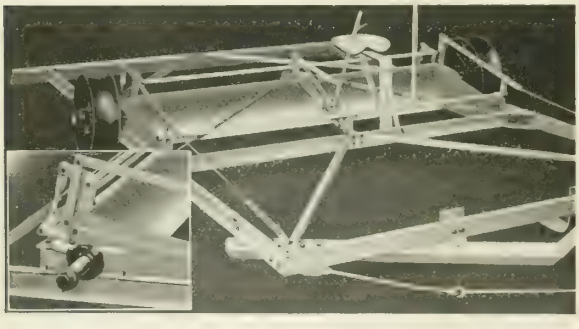
Despite difficulties, employees have set a production schedule of 25 Cubs during the 30 days following the fire while preparations are being made for a larger plant than the previous quarters.

### Bendix Acquisition

Formation of a new corporation to be known as the Bendix Aviation Corp., Ltd., and acquisition of Pacific Airmotive Corp., Ltd., which has been taken over by the new organization, was announced by Vincent Bendix during the Los Angeles air show.

Immediate plans call for further expansion of Pacific Airmotive and for manufacture of some Bendix products now being made in the east. Additional space has been leased at Union Air Terminal, Burbank, for servicing and stocking, and three floors of the Bendix building will be set aside for manufacturing and distributing automotive facilities.

Bendix will be president of the

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new organization and Palmer Nicholl, formerly with Pacific Airmotive, vice-president. The entire personnel of the acquired company will be retained and present activities will be continued on a wider scope.

## One-Bladed Propeller Test

Successfully completing a transcontinental test flight of the Everel one-bladed propeller, Arthur S. Peirce of the Taylor Aircraft Co., arrived at the Pacific Aircraft and Boat Show in Los Angeles. This test flight of a *Cub* equipped with the new propeller was sponsored jointly by the Taylor company, Sensenich Bros., who manufactured the blade and the Everel Propeller Corp.

As in New York, interest was manifest at the Pacific show in the new propeller and the test flights across the country. Officials of the Taylor company became interested in the promise of additional performance and economy when Jesse Jones of Lancaster, Pa., flew the first new propeller to the Aviation Show in New York City. In tests at that time Jones secured a top speed of 95 mph.

After arriving in Los Angeles, Peirce stated that the propeller performed as expected on the flight. It had shown excellent climb and take-off performance at altitudes ranging up to 4100 ft. such as those at Columbus and Douglas, N. Mex. Throughout the trip the propeller had held a low pitch on climb and take-off and automatically assumed higher pitches at cruising speeds and top speed and had opened out to the extreme high pitch angle at altitudes ranging up to 9000 ft.



*Arthur Pierce in the Taylor Cub equipped with a single-bladed Everel propeller*

This report also was borne out by the performance reports on a Cessna which was flown to the Pacific show propelled by another one-bladed propeller. Passengers on the Cessna on this flight were Frank Ellington, president of the Everel company, Walter W. Everts, inventor of the single-blade device and Jesse Jones, Everel test pilot. Speed of the Cessna was maintained at 140 mph throughout the trip and the records showed a saving of 1.5 gals. of fuel per hour. Figures on the Cub, on the other hand showed a mileage of approximately 10 mph greater speed than with a two-bladed propeller.

## New Dealers

Erickson & Remmert, Floyd Bennett Field, Brooklyn, N. Y., for Porterfield in the Metropolitan area.

* * *

R. P. Bowman, Oakland, Calif. and Jim Webster, Los Angeles, Calif., for Stearman-Hammond.

* * *

Inter City Airlines, Inc., E. Boston, Mass., for Stinson in most of New England and Aeronca in all of New England.

* * *

Rochester Aeronautical Corp., Rochester, N. Y., for Taylorcraft in upper New York.

* * *

Washington Aircraft & Transport Corp., Boeing Field for Fleetwings in the state of Washington.

* * *

H. C. Robbins Co., Cleveland Municipal Airport, for Fleetwings, in Ohio except southern and northwestern counties.

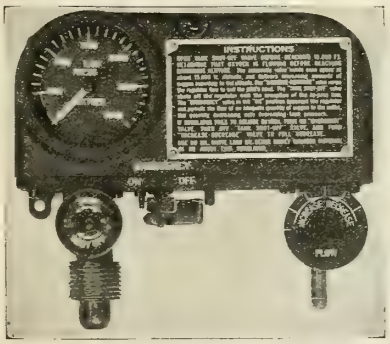
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Franklin Rose Aircraft, Inc.,

(*Continued on following page*)


**AUTOMATIC OXYGEN REGULATOR**

TYPE O5A




TYPE O5A

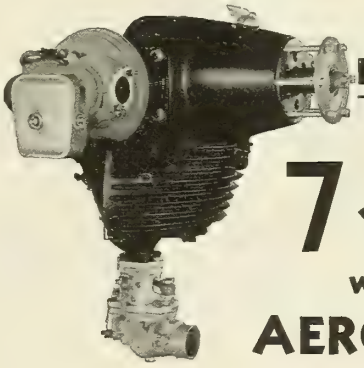
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This Regulator is the result of 14 years of development and experience in furnishing regulators to Governments throughout the world, being standard equipment with many. It is of the gaseous (cylinder) oxygen type for use with either mouthpiece or mask. The volume of flow is automatically controlled by the altitude.

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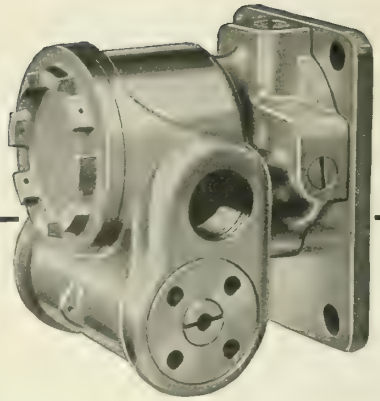
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For seven years Aeronca has entrusted to us the precision work of machining the major parts of Aeronca engines. The same high degree of accuracy which has made Aeronca engines noted for their superior performance is assured to all who avail themselves of Govro-Nelson service.

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San Francisco


*(Continued from preceding page)*

Mills Field, San Francisco, for Ryan in northern California.

* * *

Demorr Aeronautical Corp., Main Line Airport, Paoli, Pa., for Ryan in eastern Pennsylvania and northern New Jersey.

## Personnel Notes

Art Chester has joined Menasco Manufacturing Co., as head of the company's service department. Chester will be assisted by Russell Chambers and A. C. Hewitt.

# Coming Events

Meeting. International Association for Testing Materials. International Congress; London, Eng. Apr. 19-24

•

Michigan Airport Conference. Rowe Hotel, Grand Rapids. Apr. 29-30

•

Annual Air Show. Purdue University Airport, Lafayette, Ind. May 23

•

Air Races. Lambert-St. Louis Airport. St. Louis Air Race Association. James R. Ewing, manager. May 29-31

•

First Salon International de Aeronautique. Palais du Centaire, Belgium. Sponsored by Ministry of Transport and Belgium Aero Club. May 26-June 6

•

International Air Show. Special feature Chicago Centennial Jubilee. International Amphitheatre, Chicago. June 12-20

•

Air Meet. Findlay, Ohio Municipal Airport. In conjunction Golden Celebration of Gas and Oil. June 23

•

Fifth Annual Air Show. Junior Chamber of Commerce. Marshall, Mich. Municipal Airport. June 26

•

Fourth International Aviation Meeting. Zurich, Switzerland. Aero Club of Switzerland. July 23-Aug. 1

•

National Air Races. Municipal Airport, Cleveland, Ohio. Cliff Henderson, managing director. Sept. 3-6

•

SAE National Aircraft Production Meeting. Los Angeles, Calif. Oct. 7-9


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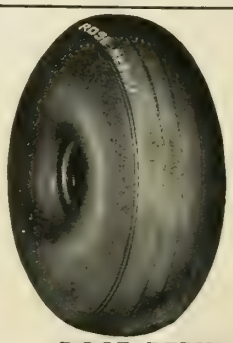
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| 22:10 x 4.... | 11.00 | 8:50 x 10... | 11.65 |
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*Main buildings at the training base for ground personnel. This base is at Trenton, Ontario*

# TRANS-CANADIAN AIRWAY

JAMES MONTAGNES

● After building a chain of emergency landing fields in the uninhabited bush regions of northern Ontario, Canada opens its much-heralded northern trans-continental airway on July 1. Linking Halifax with Vancouver in 16 to 18 hours, Europe- and Asia-bound mails will travel in new Douglas transports, six of which it is understood, have been ordered by the Canadian government for the new service. The new airway was designed not only to speed domestic mails but also as a vital link in the British Empire air service.

The Canadian government has gone to great detail in establishing a ground system of safety aids, which include a series of more than 25 four-way radio directional compasses, built and designed in the Dominion. These stations will give four bearings simultaneously, one in each sector, and neither pair of which need be direct opposites, thus giving four distinctly different bearings.

In the Rocky Mountain sector of the route, special radio beacons have been installed to overcome difficulties found to result from the surrounding high peaks. The mountain route is through Crow's Nest Pass, the lowest pass on the route to Vancouver among mountains more than 9000 ft. above sea level.

Ground operations of the airway will be carried out by the Air Service Branch of the Dominion Department of Transport, and includes (besides the radio beam stations) marker radio beacons, the latest in floodlighting, boundary lights, and searchlights on all main and emergency landing fields. A teletype weather service with hundreds of weather observation stations sending in data is ready to start operations. Close to $10,000,000 will have been invested by the government on the ground and safety system when the airway opens for mail traffic this summer.

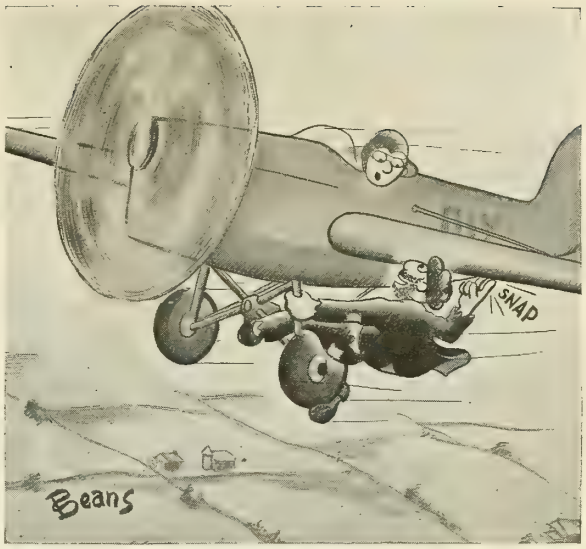
The route will be from Halifax to St. John across the state of Maine, to Montreal, where the trans-Atlantic and United States routes connect. From Montreal via Ottawa, Elmsdale, Cobalt across northern Ontario to Winnipeg, Regina, Lethbridge, Cranbrook, Princeton to Vancouver. United States lines connect at Winnipeg and Vancouver. Arctic routes connect at Winnipeg and Lethbridge.

A difficulty on the route was

(*Continued on following page*)



*A radio station in the western section of trans-Canadian Airway*


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(*Continued from preceding page*) the bridging of northern Ontario, where virgin forests, lakes and a trans-continental railway right of way are the only landmarks. This northern route (instead of the Lake Superior crossing) was chosen because it is comparatively free of fog. It required the clearing of 30 fields from virgin forest, dynamiting stumps, taking out rocks and boulders and filling in muskeg. Telephones now link these northern fields.

The airway will operate for the first year with mail and express. Passengers are not expected to be carried for some time, but may be flown on limited sections. The airline will be a private company with railway and Canadian government financial interest.

When the service gets under way, the transports will leave Montreal with mail about 6 p.m. and be in Vancouver in time for delivery of mail the next afternoon, Hon. J. C. Elliott, Postmaster General told the House of Commons during consideration of post-office estimates.

The schedule will be so arranged that the 3000-mile route will be flown in the night, with the exception of the hop through the Rockies.

# FOREIGN NEWS IN BRIEF

## Australasia

The government has contracted with Commonwealth Aircraft Corp., Ltd., for the supply of 40 military planes. The first contract calls for the manufacture under permit, of North American NA-16 all purpose aircraft for the Royal Australian Air Force. When completed, these machines will be the fastest military aircraft in Australia.

Union Airways Ltd., will purchase three Lockheed Electra transports for service in New Zealand.

Annual report of the Civil Aviation Board for 1935-6 states that overseas mail loadings were such that the revenue from special air charges on these mails was greater than the subsidy cost of the Brisbane-Singapore service. Mail traffic for the first six months of 1936 was 70% greater than for the same six months in 1935, while the weight of local mails increased by more than 50%.

A new Government-subsidized air route from Brisbane to Adelaide will be opened this year to provide cross country connection between Brisbane and Adelaide for the new flying boat service. It will be operated by C. A. Butler until the termination of his Charleville-Cootamundra contract in 1939. This route will be discontinued.

Australian National Airways Ltd., has been bidding for control of Airlines of Australia Ltd., which would give it control of all major air services around the coast from Perth to Townsville, and to Tasmania. Negotiations, however, have been discontinued, as a clause in the articles of Airlines of Australia does not allow voting power over 25% of the total number of shares issued.

Intercity Airways has re-opened the Sydney-Broken Hill air route —625 miles across New South Wales—with a twice weekly service in each direction. Australian built Gannet with twin Gypsy VI engines are used.

Airlines of Australia's fourth Stinson is now in service between Sydney and Townsville. This equipment has not only enhanced the company's earning power but also found considerable favor with the travelling public.

## Canada

Canadian government's estimates for the year 1937-38 include $11,752,650 for aviation, a sizeable increase over 1936. Part of the increase is due to new defense expenditures, which include the purchase of 12 fighters, 3 army-cooperation, 7 flying boats, 24 bombers, 11 torpedo bombers, 18 coastal reconnaissance planes and 27 trainers. The R.C.A.F. is to be increased by 48 officers and 565 men, bringing the permanent force to about 1700. The non-permanent force is also to be increased to make a total of 1075. Expenditures for civil aviation now come under the Department of Transport.

The Toronto Flying Club's new officers elected at the annual meeting early last month are: Sidney B. Cleverley, pres.; W. M. Alexander, vice-pres.; J. O. Shaughnessey, sec., and J. M. Burgess, R. E. H. Bowman, T. R. Loudon and H. R. Bertram, directors.

General Airways, Ltd., Wings Ltd., and Mackenzie Air Service, Ltd., are being amalgamated and will be known as United Air Services. These companies have all been active in flying passengers, freight and express to mining districts from eastern Quebec

to the Pacific coast. Combined they have 26 planes as well as radio stations, and they will continue under their present individual managements. The purpose of the amalgamation is to effect a saving by the joint purchase of planes, equipment and supplies.

deHavilland Aircraft Company of Canada, Ltd., in its statement for the fiscal year ending September 30, 1936, reports sales reduced from $160,275 a year ago to $155,942, a small reduction in gross profits from $21,954 to $21,247 and a decrease in the deficit carried forward from $30,683 to $28,000.

Relics of the earliest developments in Canadian aviation are now being preserved, and the story of Canada's part in the progress of aviation will be told in a collection now being assembled for the newly established aeronautical museum housed in the building of the National Research Council in Ottawa.

Fleet Aircraft Corp., Fort Erie, Ont., received an order for 20 training planes from Argentina. According to J. W. Sanderson, general manager, the planes will cost about $100,000. This is the first order for training planes which the new Ontario Fleet plant received from a country in South America.

## France

Air France is expected to carry passengers between Buenos Aires and Santiago, Chile, using twin-engined Potez 62, 10-passenger planes having a cruising speed of 155 mph. Heretofore only mail has been carried on this transcontinental section. Authorization to carry passengers has been obtained from the Argentine Government; similar authorization is expected to be granted by the Chilean Government, and equipment is being assembled in Argentina for the service.

## Great Britain

Twelve four-engined landplane airliners will go into service on Imperial Airways routes this year, supplementing on important stages the operations of the flying boat fleet.

The new Armstrong Whitworth landplanes are high-wing monoplanes equipped to carry up to 42 persons in four passenger compartments. Maximum speed will be approximately 200 mph, and gross weight about 20 tons, of which from 3.5 to 5 tons will be payload. With a wing-span of 123 ft. and overall length of 110 ft., the plane will be powered by supercharged Siddeley Tiger IX 14-cylinder air-cooled radial engines, mounted in nacelles built into the front of the main plane spar and driving de Havilland controllable-pitch propellers. Each engine delivers 880 hp for take-off, and 805 hp at 7200 ft.

Another of the new high performance medium bombing planes designed to meet the needs of the expanded Air Force is now undergoing test flights. A low-wing all-metal monoplane with flaps and retractable landing gear, it has been built by Armstrong Whitworth. It derives power from a 805/880 hp Siddeley Tiger radial air-cooled engine equipped with a three-bladed controllable-pitch propeller, and it is designed to carry a crew of two in enclosed cockpits.

The new bomber is notable for high speed and load capacity. Wing span is 49 ft., overall length, 44 ft., and height overall, 13 ft. Forward surfaces of the wings are metal-covered, the aft sections fabric-covered. Two types of construction are used in the fuselage; monocoque aft and the portion forward of the wing spar, of steel tubes.

The Mayo "composite aircraft" is now in final stages of construction at the Short factory, and trial flights are expected to begin within the next three months. The lower component is a four-engined boat similar to the Empire craft but with structural alterations to fit it for launching in mid-air the upper component, a four-engined float seaplane equipped to carry a heavy load of mails more than 3500 miles non-stop. Except for wing coverings and some items of installation the lower component is ready for flight.

Cirrus-Hermes Engineering Co., Ltd., has been acquired by Blackburn Aircraft Ltd., and C. S. Napier, formerly technical director of the Cirrus company, will be chief engineer in charge of design in the engine section of the Blackburn company.

## Germany

Construction of the new airship LZ-130 is progressing rapidly and it is expected that it will be completed this fall. The bow point is about ready and the aft end will be completed this month. Passenger cabins also are well advanced and the foundation for the control gondola has been laid. The two forward engine gondolas have already been attached to the framework.

(*Continued on following page*)




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(*Continued from preceding page*)

## Mexico

An airplane assembly plant is to be established in Mexico City by the Ministry of War and Marine, thus limiting imports of war aircraft to engines and wings. An appropriation of about $280,000 has been made for this undertaking. Several Douglases and Corsairs are to be reconditioned, and a considerable quantity of American machinery and equipment is to be purchased.

Arrangements are being made by the government for establishing a service that will connect northern and southern Lower California territory with the rest of Mexico. The route will be from Mexicali, capital of the northern district, where connections are to be made with Mexican Aviation's (Pan American) international and domestic lines, to La Paz, capital of the southern district at which point it will link with service of Compañia Lineas Aereas Mineras.

Compania Aeronautica del Sureste, S.A., operating in southeastern Mexico, has requested a federal permit to conduct regular service between Jalapa, capital of Vera Cruz state, and Villahermosa, the Tabasco state capital, with stops at Tejeria and Puerto Mexico, Vera Cruz.

To provide the Yucatan Peninsula with adequate service, President Cardenas has ordered the construction of landing fields at Progreso, Sisal, Temax, Celestum, Hunucma, Tixkokob, Sotuta and Muna, Yucatan state, and Puerto Morelos and San Miguel de Cozumel, Quintana Roo Territory. While these fields will be primarily for military use, they also will be available to civilians.

## Portugal

Sponsored by Manuel Bramao, distributor in Portugal of Taylor Aircraft Co., the first privately-owned flying school venture to start in Portugal was inaugurated at Cintra, near Lisbon, with a Cub as flying equipment. Sixteen students started immediate instruction and a hundred more were enrolled.

## South America

The Ministry of Public Works of the Province of Buenos Aires has issued a decree allocating about $178,968 in connection with the province's aviation program. Practically all of this sum will be expended for the purchase and development of airports located at Bolivar, Carmen de Patagones, Coronel Suzrez, General Villegas, Dolores, Pigue, Pergamino, Tres Arroyos, Azul, and Mar del Plata.

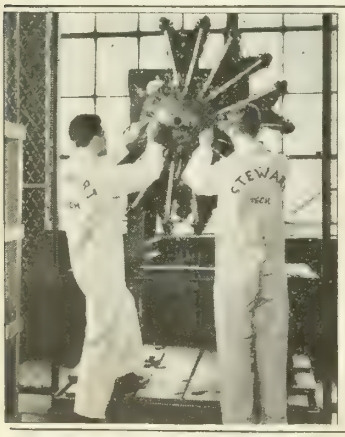
Aerovias Peruanas has extended its Lima-Chiclayo passenger-mail-express service northward to Talara. Service is maintained on a tri-weekly basis.

Services of Royal Dutch Airlines (KLM) formerly operating between Curacao and Aruba, N.W.I., and Maracaibo, Venezuela, were extended to include two trips a week between Curacao and La Guaira.

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# REVIEWS OF NEW BOOKS

## YOUR WINGS

By Assen Jordanoff

*Your Wings* is a factual and complete word and picture presentation of the art of flying. With the aid of hundreds of well-done drawings, Assen Jordanoff makes clear the basic principles of flight and carries the reader through a comprehensive course in flight instruction from solo to instrument flight and advanced aerobatics.

Taking advantage of his experience in *Learning to Fly*, Jordanoff's second work along these lines is a more rounded and complete treatment of the subject, while yet retaining some of the outstanding features of his initial publishing effort. Utilizing the tabloid method of teaching which allows a rapid grasp of the subject, the author has provided an ideal supplement to actual flight. The drawings by Frank Carlson are clear and informative and there are more than 425 of these to make the book one profusely illustrated. In short, *Your Wings* covers seemingly everything that the amateur or professional pilot, the person who uses the plane as a means of pleasure or profit, need to know or might be interested to know.

Published by Funk & Wagnalls Co., the book was released for publication January 14, 1937.

## PRACTICAL AIRCRAFT STRESS ANALYSIS

By D. R. Adams

This book is written with the object of providing a simple and practical study of the methods used in the stress analysis of aircraft components, the subject matter being based on lectures delivered by the author at the deHavilland Aeronautical Technical School.

Five chapters are divided into subdivisions of aeronautical engineering nomenclature; estimation and application of external loads to structures; strength of fittings and joints; strength of beams; strength of struts and ties; and strength of members in torsion. The examples illustrating important points were worked out on the slide-rule.

## ONCE TO EVERY PILOT

By Frank Hawks

An interesting book written by Frank Hawks, *Once to Every Pilot* reveals the experiences of pilots as told to the author in informal gatherings and talks.

In his 20 years of flying, the author has heard many yarns told by aviators, but few of these stories ever appeared in print. It was with the thought in mind that many people, whether they fly or not, would be interested in these stories that the book has been compiled. Some are the author's own experiences; others those of friends whose cooperation permitted them to be included.

Written simply and interestingly, *Once to Every Pilot* makes enjoyable reading, especially for those who know such pilots as Eddie Rickenbacker, Al Williams and others whose exploits have been conserved in print.

## RIP CORD

By Lloyd Graham

Published by Foster & Stewart Publishing Co., *Rip Cord* is an interesting work which reveals the historical background of the development of the parachute.

Building around such parachute names as Floyd Smith and Les Irvin, the book gives the story of the first parachute jumping attempts and then imparts what the author chooses to call "thrills with parachutes."

One of the most interesting chapters, from the semi-technical point, is that called "Parachutes Tomorrow." Informative data on the parachute for lowering an airplane, for use by air travelers in commercial transports and on constructional details of the parachute make this one of the most useful chapters in the book.

## ENGINEERING AERODYNAMICS

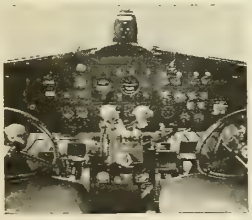
By Walter S. Diehl

Ronald Press' revised edition of *Engineering Aerodynamics* by Diehl is a greater contribution to the art than the older editions which found such favor among engineers. This book is full of

(*Continued on following page*)

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(*Continued from preceding page*)

new data and methods on applied wing theory, control surface design, performance calculation and estimation.

New methods are given to simplify many design problems and since the book always has been outstanding in practical applications of aerodynamic theory to airplane design, it becomes even more valuable. In hundreds of difficult problems, it gives by chart, formula and table, adequate and quick solutions.

In its present form, the 556-page book is essentially new, its greater part being available in printed form for the first time.

# TRADE LITERATURE

## Spring Making

Barnes-Gibson-Raymond has made available without cost to members of the industry a practical handbook of modern spring engineering for users and designers of springs. Titled the *Art and Science of Spring Making*, this book is one of the most complete, semi-technical discussions of spring making. It represents a distinct advance over the last B-G-R catalog published in 1931 and reflects in some measure the current trend of the stereotyped catalog of products. There are 88 pages of information about spring selection and design, most of it published for the first time.

In addition to discussing the characteristics of the many spring types, numerous problems in design are worked out for easier understanding. Subject matter is clearly indexed and conveniently grouped for reference and tables and formulas have been compiled for quick accurate use.

This publication should make a valuable addition to the spring-buying or designing engineer.

## Ort Catalogue

Another addition to the long line of Kart Ort catalogues has just made its appearance. Even more elaborate than any before it, the new issue is compiled in the usual Ort style and contains hundreds of items which are for sale through this aviation supply house in York, Pa.

Extensive use of half-tone illustrations and the accompanying descriptions of the articles written with the Ort touch make this issue one of the most unique and up-to-date pieces of sales literature on aviation supplies. Printed in attractive style, the booklet consists of 32 pages.

# SPAN-LIFT DISTRIBUTION

(*Continued from page* 42)

ellipse has more curvature, and hence the intersection between center ordinate with the ellipse chord is higher than its intersection with the lift plot chord. This is illustrated in figure 3, in which the two chords are drawn, and the length to be measured indicated.

These three numbers, added together, give the downwash angle at the point considered.

### Assuming And Correcting The List

If the lift distribution is not given but the wing dimensions are (no sweepback being involved), the first step toward determination of the lift distribution would be to assume a reasonable one. This may be done by applying the strip method, allowing a lift coefficient 1/10 per degree of the active angle of attack. This lift distribution is then split up or divided into one part with equal angle of attack giving the total lift, leaving a second part with total lift at zero. This second

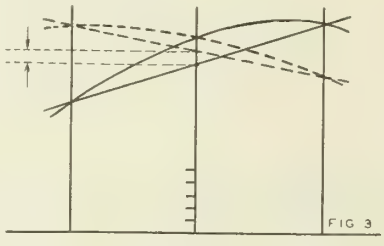


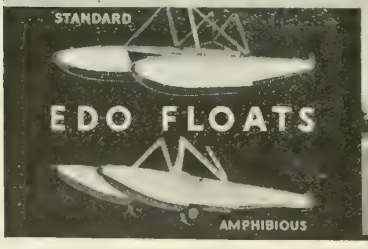
FIG 3

part is again split up into one part symmetrical to the airfoil center and another (if any) equal but opposite at corresponding points on both sides of the center. It very frequently happens that the two zero lifts parts are often zero.

The total lift portion is then reduced by dividing by $1 + 2/a$; the unsymmetrical portion is reduced by dividing by $1 + 4/a$; and the symmetrical zero part is reduced by dividing by $1 + 6/a$, where $a$ denotes the aspect ratio of the airfoil. The three portions thus reduced are then again added.

If and where the determined downwash angle reveals an excess of the angle of attack, lift must be added. This correction lift is computed from the excess angle by the strip method, allowing again 1/10 lift coefficient per degree after a suitable reduction of the excess angle. This reduction is performed by dividing $1 + 1/ma$, where $m$ is twice the ratio of the span to the span portion through which the excess angle retains the same sign.


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17. A B C of Flight. *Laurence LePage*.....$1.50
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## OFFICIAL RECORDS

*(Continued from page 37)*

### Class C-3—Amphibions

**Airline Distance:** Brig. Gen. F. M. Andrews (U. S. A.); June 29, 1936; San Juan, Puerto Rico to Langley Field, Va.; twin-engined Douglas YOA-5 (800 hp Wright Cyclones) . . 1429.754 mi.

**Altitude:** Capt. Boris Sergievsky (U. S. A.); Apr. 14, 1936; Stratford, Conn.; twin-engined Sikorsky S-43 (750 hp Pratt & Whitney Hornets) 24,950.484 ft.

**Maximum Speed:** Maj. Alexander Seversky (U. S. A.); Sept. 15, 1936; Detroit, Mich.; Seversky (710 hp Wright Cyclone) . . . . 230.424 mph

**Speed (100 Kilometers):** Lieut. Richard L. Burke (U. S. A.; June 23, 1935; Cape May, N. J.; Coast Guard Grumman JF-2 amphibion (700 hp Wright Cyclone) . . . . 173.945 mph

**Speed (1000 Kilometers):** Harry Richman and George Daufkirk (U. S. A.); Feb. 10, 1935; Sikorsky S-39 (300 hp Pratt & Whitney Wasp Junior) . . . . . 99.945 mph

**Altitude with 500-Kilogram payload:** Capt. Boris Sergievsky (U. S. A.); April 14, 1936; Stratford, Conn.; twin-engined Sikorsky S-43 (750 hp Pratt & Whitney Hornets) 24,950.484 ft.

**Altitude with 1000-Kilogram payload:** Capt. Boris Sergievsky (U. S. A.); April 24, 1936; Stratford, Conn.; twin-engined Sikorsky CS-43 (750 hp Pratt & Whitney Hornets) 19,625.745 ft.

## FEMININE RECORDS

### Class C—Airplanes

**Airline Distance:** Amelia Earhart (U. S. A.); Aug. 24-25, 1932; Los Angeles to New York; Lockheed Vega (450 hp Pratt & Whitney Wasp) . . . . . 2,447.728 mi.

**Altitude:** Mlle. Maryse Hilsz (France); June 23, 1936; Villacoublay; Potez 506 (900 hp Gnome-Rhone) . . . . . 46,948.248 ft.

**Maximum Speed:** Helen Boucher (France); Aug. 11, 1934; Istres; Caudron 450 (315 hp Renault-Bengali) . . . . . 276.527 mph

**Speed (100 Kilometers):** Helen Boucher (France); Aug. 8, 1934; Istres; Caudron 450 (300 hp Renault-Bengali) . . . . . 256.235 mph

**Speed (1000 Kilometers):** Helen Boucher (France); Aug. 8, 1934; Istres; Caudron 450 (300 hp Renault-Bengali) . . . . . 254.255 mph

#### LIGHT AIRPLANE—FIRST CATEGORY

**Airline Distance:** Helen MacCloskey and (passenger) M. MacCloskey (U. S. A.); June 25, 1936; Chicago, Ill., to Endless Caverns, Va.; Monocoupe (90 hp Lambert) . . . . . 524.151 mi.

**Speed (100 Kilometers):** Helen MacCloskey and (passenger) G. M. Savage (U. S. A.); Jan. 15, 1935; Miami, Fla.; Monocoupe (145 hp Warner Super-Scarab) . . . . . 166.632 mph

**Speed (1000 Kilometers):** Helen Boucher (France); July 8, 1934; Istres; Caudron Rafale (145 hp Renault-Bengali) . . . . . 155.396 mph

**Altitude:** Madeline Charnaux and Mlle. Clarck (France); Jan. 29, 1935; Orly; Farman 357 (120 hp Renault) . . . . . 20,062.275 ft.

#### LIGHT AIRPLANES—SECOND CATEGORY

**Airline Distance:** Marsye Bastie (France); June 29, 1931; Le Bourget to Urino, Russia; Klemm (40 hp Salmson) . . . . . 1,849.763 mi.

**Altitude:** Helen Boucher (France); Aug. 2, 1933; Orly; Mauboussin-Peyret (60 hp Salmson) . . . 19,356.897 ft.

**Speed (100 Kilometers):** Annette Gipson (U. S. A.); July 30, 1936; Newark, N. J.; Monocoupe (90 hp Lambert) . . . . . 123.253 mph

#### LIGHT AIRPLANES—THIRD CATEGORY

**Altitude:** Iona F. Coppedge and Mrs. J. Garrigus (U. S. A.); Feb. 11, 1936; Dayton, Ohio; Aeronca (36 hp Aeronca) . . . . . 15,252.439 ft.

**Speed (100 Kilometers):** Helen Frigo and (passenger) Harriett Sackett (U. S. A.); June 12, 1936; College Park, Md.; Aeronca C-3 (36 hp Aeronca E-113 A) . . . . . 74.197 mph

### Class C-2—Seaplanes

**Altitude:** Marquise Carina Negrone (Italy); May 5, 1934; Genes; Breda 15 (Isotta-Fraschini Asso) . 18,221.729 ft.

#### LIGHT SEAPLANES—SECOND CATEGORY

**Altitude:** Marquise Carina Negrone (Italy); May 5, 1934; Genes; Breda 15 (Isotta-Fraschini Asso) . 18,221.729 ft.

## POINT-TO-POINT RECORDS

#### FIRST CATEGORY

**London to Cape Town:** Amy Mollison (Gt. Britain); May 7, 1936; Percival Gull (Gipsy VI) . . . . . Duration 78 hrs. 28 min.; speed 76.215 mph

**Los Angeles to New York:** Howard Hughes (U. S. A.); January 19, 1937; Hughes Racer (P & W Twin Wasp, Jr.) . . . . . Duration 7 hrs. 28 min. 25 sec.; speed 332 mph

**Paris-Saigon:** Andre Japy (France); Dec. 16, 1935; Caudron Aiglon (Renault) . . . . . Duration 71 hrs. 18 sec.; speed 63.694 mph

#### SECOND CATEGORY

**London to Melbourne:** C. W. A. Scott and T. Campbell Black (Great Britain); Oct. 20-23, 1934; twin-engined de Havilland Comet (224 hp Gipsy Six) . . . . . Duration 71 hrs. 18 sec.; speed 159.987 mph

**Los Angeles to New York:** D. W. Tomlinson, H. B. Snead, and F. R. Redpath (U. S. A.); April 30, 1935; twin-engined Douglas DC-1 (710 hp Wright Cyclones) . . . . . Duration 11 hrs. 5 min. 45 sec.; speed 221.334 mph

**Paris to Tananarive:** Genin and Robert (France); Dec. 18-21, 1935; Caudron Simoun (180 hp Renault) . . . . . Duration 57 hrs. 35 min. 21 sec.; speed 94.396 mph

## NEW DEAL IN WAR

(*Continued from page 22*)

it in our every-day life. In 1936 there were in the Metropolitan area of New York City 17,450 fires in buildings of all types, and 11,056 brush fires—a total of 28,506 fires in the year, or 78 a day. The money loss was $8,000,000 and the loss of life 58, mostly in tenements. As the fire fighting apparatus always arrived at the scene of the fire within minutes of its start, 99.7% of all fires were confined to areas involved upon the arrival of the apparatus. But the Department only had to put out 78 fires in 24 hours.

The biggest thing in London on November 30, 1936, was the Crystal Palace, 1,600 feet long, made of iron and glass. That night a small fire started in a cloak room. But it spread rapidly, and despite the efforts of half the fire-fighting force of London, roared through that vast building and destroyed it.

In New York City a few years ago a cigarette started a fire on a Hudson River dock used by transatlantic liners. Although half the New York apparatus—all that could get near—and all of the city's powerful fire-boats did their utmost, the immense dock was completely destroyed. When a fire gets out of control, nothing can save a city: as witness the burning of Chelsea, Fall River and Chicago, all of which mighty conflagrations started from only *one* fire. The attacking air strategist purposes to start at least 50,000 and possibly 100,000 fires within a space of 15 minutes to an hour's time. There is not enough apparatus in the whole of England to put out 50,000 or even 1,000 fires that start simultaneously.

The air detachment required to destroy London need be no more than 500 modern bombardment planes, each carrying 300 small incendiary bombs, or 150,000 bombs in all. These little bombs need weigh only about 6 pounds; they are filled with thermite or other effective incendiary chemical and carry a detonator. The basic element of thermite is potassium, which burns at 1,200° F. It cannot be extinguished with water or with any of the more common extinguisher liquids. Dropped from a normal bombing height such bombs have sufficient velocity to crash through roofs and lodge in attics and floors, thus starting fires inside the buildings, over 99% of which in London have wooden interiors and furnishings—like the Crystal Palace. If only a third of such bombs hit buildings, 50,000 fires should result.

It has been suggested that the defense against such attack is to provide each house with the necessary neutralizing agent to localize each fire. A high-ranking Army officer provided me with that helpful suggestion, which I pass on

(*Continued on following page*)


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(*Continued from preceding page*)

to the English for what it may be worth. My army friend forgets, however, that in an air raid nearly all of London will be in cellars or tube underground stations, as it was in 1917. The little package of "neutralizer" probably will be in an upstairs closet. In addition to his incendiary bombs, the air commander naturally will drop enough phosgene and tear gas bombs to hamper defense, and enough high explosive bombs to make a loud, terrifying sound, mainly to divert attention from the more thorough destruction that he is starting with thousands of small fires. A fire remains small for a matter of minutes only. Furthermore, average householders make noticeably poor fire-fighters, their usual method of fighting fires at night being to rush out doors yelling for help.

Thinking over all this, the Fascist air strategist pictures the destruction accomplished in effective measures—and it is not needful that the city be entirely destroyed. He sees a London of gaunt stone and brick walls, fire-swept, smoke-blackened and desolate except for those scattered sections that have escaped the flames. But even unburned sections are practically useless as parts of a working city, for many pumping stations have been destroyed; there is no water, and a large population cannot exist healthfully in crowded conditions without running water. There is no light, no power for tramways and tube trains, no transportation except motors negotiating streets blocked with fallen debris, no telephone service. Factories, homes, shops, businesses, banks, exchanges, warehouses, docks, street cars, and many buses and other motor vehicles have been destroyed.

What has happened to the eight million inhabitants? Most of them have escaped, as it was intended that they should. Dead, they would have solved England's problem of their support; alive, they are a more pressing problem than the enemy. Of the dead, not many have upon them the marks of military death; for comparatively few explosive bombs were dropped, and but little gas; the preliminary machine-gunning, gassing and bombing of military defense positions by low-flying attack planes occupied no more than five or ten minutes, directly preceding the main bombing attack from a height of 10,000 feet or more. The greater number of the dead are smoke and fire casualties, and the number of these is not excessive in such a large population.

Where will these millions of fleeing inhabitants go? To other cities?—also to be destroyed as war continues? Into the fields and woods? Can millions of formerly sheltered human beings live exposed to the elements for any extended time? If not, where will they take shelter, especially if the attack be in winter? It may be asserted that a "planned evacua-

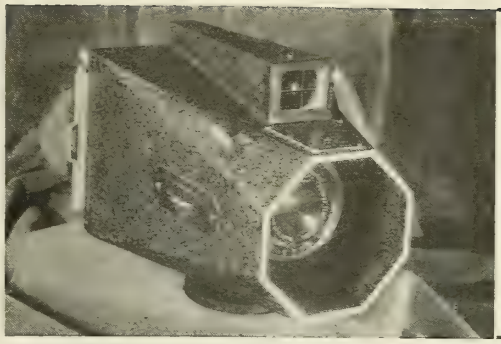
ion"—a favorite word with the military —will take care of these homeless people. But what plan adequately can care for eight million people who own nothing but the clothes on their backs and a few personal belongings?

How is the army in the field, the navy at sea, the air force squadrons scattered around the country to be directed? Headquarters and communication facilities have been destroyed or disrupted; and it is axiomatic that armies, navies, and air forces cannot be run without typewriters and paper by the ton. As Napoleon truly said—or was it General Malin Craig, Chief of Staff, U. S. Army?—"An army moves on its Remingtons." Can government itself function with its records destroyed, with its *tax lists* burned? —with the property on which taxes were paid destroyed? Wars are run on taxes. How can a war continue without taxes? They may have to declare immediate peace and round up the taxpayers to collect that indemnity.

It may be asked, "Will counter bombardment wreak as great havoc in enemy cities as the enemy effects in London?" The answer is a positive NO. In no other city in the world is a nation's life so centralized as it is in London. London is everything—the rest of England is referred to condescendingly by Londoners as "The Provinces." The decentralization of London's myriad governmental, military, air, naval, manufacturing, and business activities should have started years ago. Now it may be too late. When war starts it certainly will be too late. Furthermore, the necessity may not yet be apparent to the English people. England still thinks in terms of sea power, of iron ships and wooden-headed seamen; the centuries-old thought of a sea-faring island people cannot quickly be changed to comprehend that the English Channel has shrunk to a ditch, that the North Sea now is a pond to airplanes. Fate, aeronautical science, geography and the English stolidity of mind have stacked the cards against the English. Unless they have an ace up their sleeve, the next war pot will be hard to win. This time Uncle Sam cannot be counted on to raise, and call. He called last time and won four lead ha' pennies.

With the masses employed today in ground warfare, with the power of the ground defensive what it has become, with mines and submarines hampering sea action, it is evident that the one war arm that is able to move offensively is that of the air. The one weapon with which a nation may speedily gain a decision before the nation is prostrated is the airplane. It is the striking force *par excellence*: it delivers its blows at the heart of the enemy nation, not at its outstretched defensive armies. It can pass over armies and destroy the nation's ability to fight by destroying the fac-

(*Continued on following page*)

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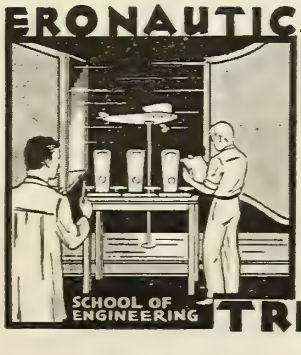


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(*Continued from preceding page*)

tories that make the equipment of war, the stores that have been accumulated, the businesses on which the civilian population depends, the houses in which they live, the buildings and the facilities used by government and by military commands. But the effective use of air power requires *intelligence and imagination,* the employment of means on a broad scale *for gaining advantage in war.*

The old-fashioned earthbound gentlemen of the General Staff, U. S. Army, shocked at the reasoning which points to this coming use of air power, will mumble something about the "ethics" of this higher form of war. But war knows no ethics; it knows only necessity. The airplane is the one war weapon that may be used humanely to destroy *things* instead of human beings. Will our own Chief of Staff contend that it is more ethical, more kindly, just, and humane to blow millions of human beings to fragments, to maim and blind men and burn them with mustard gas and chemical flames, than it is *merely to burn buildings?* Even the pacifists, those gentle, impractical idealists in our monkey-cage of civilization, should approve this new, humane form of warfare—a war of men *against* material things.

NOTE: This is the second of a series of articles on air power and war, the first of which was published in the January, 1937, issue of AERO DIGEST.

## CURTISS WIND TUNNEL

(*Continued on page* 46)

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1936 LOW WING Aeronca: 196 hours; perfect condition. Will take Cub in trade. $1,795. Hinson Motor Co., 610 Baltimore Boulevard, Cottage City, Md.

DE LUXE '35 MASTER C-3: Engine '36 factory conversion 45 hours back; streamline wheels, brakes, lights, air speed, compass, heater, waxed. Private. $1,095. Jean Rockwell, 2813 Watson Road, St. Louis, Missouri.

HIGH WING: Three months old, 50 hours total. Many extras. Perfect condition. $1,150. Fred C. Williamson, Box 31, Cockeysville, Maryland.

AERONCA C-3 MASTER: 113-C motor; extra gas tank, compass, heater; 170 hours total time, new May, 1935; never cracked; $1,025. Orval Denlinger, 140 Warren Street, Dayton, Ohio.

'34 AERONA C-3: Guarantee no time since complete motor major. Enclosure, heater; fabric excellent. Licensed. Tires fair. $795; can finance. "A1" Leeward, New Kensington, Pennsylvania.

FOR SALE: Aeronca, high or low wing, brand new, still at factory. Will accept Fleet in trade. Private party. AERO DIGEST, Box 2559.

AERONCA: Low wing; 85 LeBlond; total time on airplane 125 hours; new engine; perfect condition throughout. Finance 50%. John T. Corrodi, Inc., Box 185, Bexley Station, Columbus, Ohio.

1936 C-3 DEMONSTRATOR: 2 doors, brakes; like new. Have taken on distribution of "Cub," which accounts for our being more than usually anxious to dispose of this job. Burnham-Miller Flying Service, Muny Airport, Omaha, Nebraska.

### *American Eagle*

AMERICAN EAGLE: Kinner K-5. Licensed. 15 hours since top overhaul. Ship and engine excellent condition. Airwheels. $575 cash. W. K. Norman, Columbia, Tennessee.

AMERICAN EAGLE: 3-place; Kinner K-5, side exhaust. All in good condition; only $575. W. C. Book, Nacogdoches, Texas.

AMERICAN EAGLE 129: Just relicensed; new prop, airwheels; $625. $325 down. DePonti Aviation Co., Inc., Minneapolis, Minnesota.

KINNER K-5 American Eagle: 3-place; side exhaust; Model 129. Steel prop, electric booster starter. $595; can finance; $250 down. "A1" Leeward, New Kensington, Pennsylvania.

AMERICAN EAGLE 201: K-5; steel prop; brake type airwheels; licensed. $600 or will sell parts. Want Eaglet wings. C. Feris, 4653 West 64th St., Chicago, Illinois.

### *Arrow*

ARROW SPORT: Kinner K-5; about 700 hours. Licenseable. All new covering except lower wing. Good buy. Highest bidder gets it. 820 N. Jefferson, Kahoka, Missouri.

ARROW SPORT: Best Arrow in East. Motor majored. Special landing gear; excellent condition throughout. Gus Wieland, 447 Whitlock Avenue, Bronx, New York.

### *Amphibions, Inc.*

PRIVATEER AMPHIBION: Less motor. Excellent condition, with prop. New floats licensed for 2,365 pounds, fit Waco F's. Lewis Holy Name School of Aeronautics, Lockport, Illinois.

### *Aristocrat*

FOR SALE: Aristocrat. Recovered, relicensed. Less motor and prop. $1350. Fred Vilsmeier, 857 East Luzerne Street, Philadelphia, Pennsylvania.

### *Beech*

BEECHCRAFT B-17-L: Privately owned, never injured. Jacobs 225 hp; total time 270 hours; just completed major overhaul and installation latest type shielding; fabric like new; red, black stripes. Regular instruments plus flares, landing lights, clock, metal propeller, Western Electric radio receiver, motor cover, tools, stakes and two practically new Russell chutes. Hangared San Francisco Airport, care Pacific Airmotive, Price, overhauled, $6,500. Licensed to April 1938. E. S. McCurdy, Mills Building, San Francisco, California.

1935 BEECHCRAFT: Jacobs. Radio, night equipped, good set instruments, extra tank, 197 hours since overhaul. Make excellent charter ship. $4,900. Inter City Airlines, Boston Municipal Airport, Boston, Massachusetts.

BEECHCRAFT B-17-L: In excellent condition; Jacobs 225 hp. major overhauled, modernized 256 hours; new cylinders, crankcase. Total time now 340 hours. Fabric like new. Color, red, black striping. Hangared North Beach Airport, New York City. Extras include Curtiss metal propeller, RCA radio receiver, landing lights, three flares, Pioneer clock, synthetic leather upholstery, thermocouple and following brand new instruments: shock-proof instrument panel, turn-bank, rate climb, 941 Pioneer compass, directional gyro, Kollsman sensitive altimeter, rotable air speed, manifold pressure, outside air temperature, carburetor temperature and air time recorder, motor cover. $4,950. AERO DIGEST, Box 2579.

### *Bellanca*

FOR SALE: Bellanca C.H. Six-place, J-5 motor; 10 hours since major. Plane in excellent condition; flares, landing lights and radio. $1,600. With loud speaker equipment, audible from 3,000 feet, $3,000. We guarantee this airplane speaker equipment satisfactory. Aero Contractors, Inc., Allegheny County Airport, Pittsburgh, Pennsylvania.

### *Bird*

BIRD: 4-plate; Kinner 125, late type heads on engine. Just relicensed. Float fittings, collector ring, steel propeller, oleo landing gear, brakes, semi-air wheels. A good buy at $1,250. Also Aeronca C-3, first class condition, $675. S. Reich, Roosevelt Field, Mineola, New York.

KINNER BIRD: 100 hp; 3-place; duals, wired for lights. New prop and exhaust ring. Guaranteed in perfect condition. $975 cash. Middletown Flyers, Inc., 200 North St., Middletown, New York.

### *Buhl*

BULL PUP: Less than 100 hours on ship and motor. Licensed, condition perfect. Dandy ship for low cost flying. $475. Midwest Airways, Inc., Box 147, Cudahy, Wisconsin.

BUHL BULL PUP: Szekely; just had top overhaul on motor; snappy paint job, brown and cream; never been cracked up. Price, $425. Jennings Bros., Grafton Airport, North Grafton, Mass.

BUHL BULL PUP: Original demonstrator; total time 65 hours; just like new. Sun Batteries, 10521 Gratiot, Detroit, Michigan.

BUHL SEDANS: 6 and 8 place. Both ships recently recovered and licensed. Equipped for night flying. Priced to sell and a big bargain to someone that can handle the pair. Sun Batteries, 10521 Gratiot, Detroit, Michigan.

BUHL BULL PUP: Perfect condition; a real buy at $485. $250 down. DePonti Aviation Co., Minneapolis, Minnesota.

### *Cessna*

SLICKEST Warner Cessna in country: Fabric, motor perfect; semi's, 650 x 10; navigation, landing lights; heater, tail wheel, new upholstery, blind flying instruments. $1,200. Alford's Flying Service, LaGrange, Illinois.

### *Command-Aire*

CHALLENGER COMMAND-AIRE: Challenger motor, Curtiss-Reed propeller, Bendix wheels, brakes, navigation instruments. 100 hours since recovering. Inquire about this worthwhile buy at $500. Address AERO DIGEST, 230 Boylston Street, Boston, Massachusetts.

COMMAND-AIRE: Siemens-Halske 113 hp, 3-place. Excellent condition; motor just overhauled. Must be seen. Best offer accepted. Columbia Airways, Bloomsburg, Pennsylvania.

### *Cub*

LATEST MODEL CUB: Only 7 months old; condition excellent; carburetor heater, enclosure and air speed; $900, no less. Phil Miraglia, 208 Irvington Drive, Tonawanda, New York.

CUBS: E-2, 1935; fabric, finish, prop, tires, general condition excellent. New magneto, enclosure, windshield, skylight. $695 cash or finance. 2 J-2's, both less than year old. All yellow and excellent. Each $945. Any of above ships ready for immediate service without repairs. Free instructions and hangar rent to purchaser. J. Willard Miller, Cub Distributor, Lock Haven, Pennsylvania.

1935 TAYLOR CUB: $300 down. Special paint job, equipped winter enclosure, etc. Curtiss Junior with new 1938 license, $150 down. Pioneer Aviation, Airport, Syracuse, New York.

$890 E-2 TAYLOR CUB: Winter enclosures; many extras; like new; total time 174 hours. J. E. Blythe, 1108 East Admiral, Tulsa, Oklahoma.

TAYLOR CUB J-2: 1936 model; heater, winter enclosure; licensed; color yellow. Like new; privately owned. Perfect condition. Always hangared. Sacrifice, $895. AERO DIGEST, Box 2571.

1934 TAYLOR CUB: 320 hours. Licensed until November 1937. Aeromarine motor, majored 15 hours ago. Never cracked or damaged in any way. New windshield and cowling. Outperforms anything in its class; a steal at $880. Write, fly in or call H. E. Frost, West Haven Airport, West Haven, Conn.

1935 TAYLOR CUB: Silver trimmed in maroon. 675 hours total, 40 since major on engine and ship. Looks like new. $895. $450 down. Will take trade. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

1936 TAYLOR CUB: Looks like new. 230 hours total. 5 hours since major on motor. Finished in yellow. Absolutely perfect. Extras. $995. Will take trade. St. Louis Flying Service, Inc., St. Louis, Missouri.

CUB DEMONSTRATORS: 1936, 1937. Like new; $950 up. 1935 Cubs, overhauled and relicensed, $750 up Eaglet, excellent condition, $550. Other bargains, three-place jobs, cabin planes; can finance. Write us. Bennett Air Service, Hightstown ("Cubtown"), New Jersey.

TAYLOR CUB: 40 hp; 200 hours; motor just majored; $1 025 $500 down. DePonti Aviation Co., Inc., Minneapolis, Minnesota.

TAYLOR CUB: 40 hp; 40 hours total. Cannot be told from new. $1,100; $550 down. DePonti Aviation Co., Inc., Minneapolis, Minnesota.

1935 CUB: Motor converted to latest series; red and silver; good condition. Indiana Air Service, Bendix Field, South Bend, Indiana.

TAYLOR CUB: Brand new; ordered but not delivered. Can furnish as you specify. Will consider your car as part payment, finance balance. I. Walter Sell, 566 Vine Street, Johnstown, Pennsylvania.

### *Curtiss Robin*

CURTISS ROBIN OX-5: Scintilla, Millerized, new motor, compass, air speed; excellent condition, just licensed. Must be seen. Best offer accepted. Columbia Airways, Bloomsburg, Pennsylvania.

CHALLENGER ROBIN: $400 down; new December license; steel propeller, fabric perfect; see this airplane. OXX-6 Robin, oleo landing gear, $250 down. Pioneer Aviation, Airport, Syracuse, New York.

CHALLENGER ROBIN: Licensed to November, 1937. Curtiss-Reed propeller, tailwheel. Only 81 hours since engine major. $895. $445 down. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

$550 DOWN BUYS best Challenger Robin in the country; air starter, new airwheels, new covering, new upholstery, motor overhauled. Trade in your light car or airplane. Balance financed. Central Air Service, Inc., Grand Rapids, Michigan.

BEST CHALLENGER ROBIN in East: Must be flown to be appreciated; will trade for 3-place open Kinner job. Share in Szekely Flyabout. AERO DIGEST, Box 2584.

CURTISS ROBIN: Millerized; Stinson combination paint job, hand rubbed finish, red and silver; semi-airwheels, brakes, tailwheel, licensed April 1938. Bargain. $585. Nelson Weber, 920 W. Laurel, Springfield, Illinois.

### *Curtiss-Wright*

CURTISS JR.: Modernized late Szekely, excellent condition; 200 hours since new. Ship licensed to January 1938. E. Newkirk, 114-01 211 Street, St. Albans, L. I., New York.

CURTISS-WRIGHT JR.: Motor and ship in good condition. 400 hours. Licensed until November 1937. Price, $350 cash. Aubrey Blackburne, Route 3, Columbia, Tennessee.

CHALLENGER FLEDGLING: Electric sign carrier with special equipment; excellent condition; will consider trade. H. Archambault, 131 Eden Street, Waterbury, Connecticut.

J6-7 CURTISS 6-place Thrush: Hand rubbed finish, brakes, landing lights, less than 100 hours since factory major on engine; ship excellent condition; $1,350. J. Thomas, 2903 Meadowlark Avenue, Louisville, Kentucky.

CURTISS FLEDGLING: 185 hp Challenger, just majored. Fuselage recovered, extra instruments, starter; licensed until January 15, 1938. $750. Hartford Flying Service, Rentschler Field, East Hartford, Connecticut.

CURTISS JUNIOR: Licensed June, 1937. Motor majored. Must sell. A give-away at $250. Write, wire or see it at: Joseph Bokus, 649 E. 48th St., Brooklyn, New York.

FLEDGLING: Challenger 185; blind flying, duplicate instruments, hood. Ship and engine fine condition. Low oil consumption. A. C. Lorenz, 828 East 12th St., Brooklyn, New York.

CURTISS JR.: Recently rebuilt; motor majored, steel cylinders. New prop, tires. Licensed October $395. Motorcycle accepted part payment. Carlos Fajardo, 56 West 125th Street, New York, N. Y.

### *Driggs*

ROVER DRIGGS SKYLARK: Completely rebuilt at factory August, 1935; 75 hours time since rebuilt; equipped with brakes and all necessary flying instruments; hand rubbed finish on fuselage and wings; ship like new. $900 cash. G. D. Owsley, Glenview, Illinois.

### *Eaglerock*

OXX-6 EAGLEROCK: Motor just majored. Turns 1525 on ground. New Fahlin propeller. Fabric good. Finished blue and orange. Sacrifice, $435. Bob Hyde, Ben Pay Hotel, Mankato, Minn.

EAGLEROCK HISSO: Ship and motor just completely major overhauled, including new covering. $495. $295 down. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

$150 DOWN BUYS OX combination Eaglerock, recently recovered, licensed, not restricted for acrobatics. Excellent condition. Will accept car or airplane in trade. Balance financed. Central Air Service, Inc., Grand Rapids, Michigan.

### *Fairchild*

FAIRCHILD 24: Ranger powered 1936 demonstrator with directional gyro, bank and turn, rate of climb; many other extras; 85 hours since new September; priced for quick sale. Telegraph "Fairavia," New York.

FAIRCHILD 24: Warner 145 hp., 170 hours; always hangared. I purchased ship new June 1935. Has heater and ventilator, generator, blind flying instruments R C A radio, etc. Vermilion and dawn gray. Must be seen to be appreciated. Bargain at $3,950. Reason for selling, buying larger ship. Jack Forshner, Greenwood, Mississippi.

FAIRCHILD 22: Cirrus, 175 hours since major. Standard equipment. Just refinished. Make excellent trainer for small operator. $1,095. Inter City Airlines, Boston Municipal Airport, Boston, Mass.

FAIRCHILD 24: Built last August. Equipped with RCA radio. This ship perfect in every respect. An outstanding bargain. $4,375. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

1935 FAIRCHILD 24: Warner. Gray and orange. 240 hours on motor since new, 326 on ship. Absolutely perfect condition. Radio. $3,495. $2,000 down. Will take trade. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

LATEST MODEL 2-place Fairchild 24: 125 hp Warner; sport landing gear, pants, landing lights, generator, starter, radio receiver, full instruments; just factory overhauled and engine majored; $2,750. V. B. Murray, Room 49, Treasury Bldg., Washington, D. C., or Ray Brown, Flushing Airport, Flushing, L. I., N. Y.

FAIRCHILD RANGER: New October 1936. Only 70 hours. Immaculate. Generator, turn and climb. $5,250. AERO DIGEST, Box 2582.

FAIRCHILD KR-21: Just recovered, steel prop, ring, motor just majored; rubbed finish; red with white trimming; $1,250. $700 down. DePonti Aviation Co., Minneapolis, Minnesota.

FAIRCHILD KR-31: OX-5; complete set instruments; full air wheels; new mail type windshield; one of the best flying OX jobs ever built. $495 or less with standard wheels; finance 50%. John T. Corrodi, Inc., Box 185, Bexley Station, Columbus, Ohio.

FAIRCHILD KR-21-B: Covering year old; Kinner B-5, perfect. Steel propeller, air wheels, brakes; like new. Always hangared. $1,500. W. H. Wilhelm, P. O. Box 792, Alliance, Ohio.

### Fleet

FLEET DE LUXE: Kinner engine recently majored, covering good, exceptionally attractive paint job. Full airwheels, Heywood starter, airspeed indicator, front cockpit cover, army type windshield. Good for trainer or especially nice as private airplane. $1,300. Box 545, Wilmington, Delaware.

FLEET WARNER: Licensed, fabric and condition perfect. Airwheels and steel prop. Priced for quick sale. Midwest Airways, Inc., Box 147, Cudahy, Wisc.

FLEET: WARNER powered, just recovered, $550 down. OX Travel Air, recovered, $250 down. Warner Command-Aire, $250 down. Lambert Monocoupe, $600 down. Pioneer Aviation, Airport, Syracuse, N. Y.

### Ford

FORD TRIMOTOR: Wasp 5-AT; 17-place; electric starters, radio, new Aerol shock struts; licensed till December 15th. Best barnstorming plane in country. $4,300. Norton Air Service, Norton field, Columbus, Ohio.

FORD 4-AT-E; powered with three J6-9's. Motors modernized. De luxe ship with attractive interior. Polished finish. Full night flying equipment, blind flight instruments; Lux fire extinguisher system; spares. Only 1375 hours total time. Barnstormed very little. Motors regularly majored by approved agencies. First class throughout, $4,500. Holland G. Bryan, Court House, Paducah, Kentucky.

### Great Lakes

GREAT LAKES: Delivered new April 15, 1936. Less than 200 hours. Finished International orange and cream, wax gloss finish; new condition throughout. Compass, air speed, bank-turn, inclinometer, position lights, other standard instruments; duals; never damaged, never used for instruction or passengers; always hangared. Will take late model Chevrolet part payment. Licensed to April 15, 1938. Price on request. J. B. King, 1802 West Forest Home Avenue, Milwaukee, Wisconsin.

GREAT LAKES 2T1A: New engine and special equipment; landing lights; navigation lights; wheel pants; brakes; bank and turn; front cockpit cover; mail type windshields; condition excellent throughout; $1,200; finance 50%. John T. Corrodi, Inc., Box 185, Bexley Station, Columbus, Ohio.

GREAT LAKES: 2T1A. Spare Cirrus motor; adjustable steel prop. A snap, $895. Can finance. Aeroncas; parts. Sky-Ad Banner; 6 x 60; complete, $65. J. A. Simcock, Front & Roosevelt Blvd., Philadelphia, Pa.

### Heath

HEATH PARASOL, Model LN-A-40: Only 30 hours time both plane and engine. Licensed to March 1, 1938. Will see for $450 cash or take a small car in trade. D. E. Ranere, 219 White Horse Pike, Hammonton, New Jersey.

FOR SALE: Heath Super Parasol, $165. Heath Henderson motor, $50. Szekely motor, $75. Horace G. Miller, Bridgewater, Virginia.

### Inland Sport

INLAND SPORT: High wing monoplane, side-by-side. Warner 90, steel prop, electric starter, turn and bank. Licensed until July 1937 and in perfect condition. $750 cash or trade for another plane, Cub preferred. H. G. Hippel, Brooks Hall, Waco, Texas.

### Kellett

KELLETT K2A AUTOGIRO: Continental 210 hp. Less than 150 hours on engine; 450 hours on ship. Side-by-side seating. Completely overhauled. Privately owned. Closed cabin. Licensed. Good for advertising and dusting. Steel propeller. Hangared. $1,800 cash. AERO DIGEST, Box 2585.

### Laird

LAIRD; Wright 330. Only 197 hours guaranteed time since new. Beautiful high-gloss finish. Turn and bank, rate of climb, electric starter. $2,975. Will finance or take trade. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

FOR SALE: Wasp Speedwing Laird, less engine and propeller. Ship recovered December, 1936; color: red fuselage, white wings. Price, $1,500; includes bumped NACA motor ring. Mackey Flying Service, Findlay, Ohio.

### Lincoln

CRACKED OXX-6 Lincoln-Page: 3-place; fabric good; needs lower wings and landing gear; eligible for license. $100 cash. John Chalker, Dothan, Ala.

### Monocoupe

LAMBERT MONOCOUPE: 500 hours total; heater, semis, engine and fabric perfect, steel propeller; licensed late '37. Alford Flying Service, LaGrange, Illinois.

MONOCOUPE LAMBERT: New factory rebuilt engine, 38 hours. Ship perfect; 700 hours total. New pyralin, color red. Finish exceptional. Bargain for $1,200. Offer solicited. Located near Albany, New York. AERO DIGEST, Box 2552.

MONOCOUPE 113 Special: Powered with Warner Scarab 125; time less than 500 hours. Standard instruments. Licensed to June 1937. Must be seen to be appreciated. Write Lucille Treiher, 414 South G Street, Hamilton, Ohio.

VELIE MONOCOUPE 113: Privately owned and flown. Always hangared. Licensed to August 1937. A buy at $435 cash. Henry J. Hekrdle, Redfield, South Dakota.

MONOCOUPE LAMBERT: Excellent condition; licensed, steel prop, turn and bank, compass, air speed, landing and navigation lights, radio. Motor majored less 100 hours ago. Ship used for blind flying. $1,385. Midwest Airways, Inc., Box 147, Cudahy, Wisconsin.

LATE '33 OR early '34 Monocoupe: Warner; total time 270 hours. $1,450. J. E. Blythe, 1108 East Admiral, Tulsa, Oklahoma.

IDENTIFIED Velie Monoprep: Enclosed; new Gardner prop; 20 hours since majored; perfect condition; always hangared. Speed indicator. $250, cash. Jake Cebula, Rhinelander, Wisconsin.

BARGAIN: Latest Monoprep built; motor just majored, ship refinished; winter enclosures, cabin heater, duals; just relicensed. $550 or trade. Lester Jolly, Devils Lake, North Dakota.

VELIE MONOCOUPE: $450. Excellent condition. 60 hours since factory major. Licensed to September, 1937. Extras. Art Mostyn, Boulevard Airport, Roosevelt Blvd., Philadelphia, Pa.

MONOCOUPE: Powered with Warner Super-Scarab 145 motor. Time less than 200 hours since new. Equipped for night flying. Bonded, shielded for radio. Radio receiver installed. Tunnel cowling. Very clean. Becker-Forner Flying Service, Inc., Jackson, Michigan.

FOR SALE: Late model D-145 Monocoupe, powered with 145 hp Warner motor. Equipped for night flying; also radio equipped. Built to cruise 140 mph. Top, 160. Well streamlined. Price, $2,850. AERO DIGEST, Box 2578.

LAMBERT MONOCOUPE: 335 hours total time; 73:00 hours on engine since complete major. Airplane recovered and finished in high lustre throughout. Special equipment: Left door, engine cowling; wheel pants; tail wheel; special upholstering and clock; $2,050. Finance 50%. John T. Corrodi, Inc., Box 185, Bexley Station, Columbus, Ohio.

LAMBERT MONOCOUPE: Motor factory rebuilt; heater, brakes, air wheels; never damaged, privately owned. Excellent condition. 355 hours. $1,350. Central Aeronautical Corp., Municipal Airport, Indianapolis, Indiana.

VELIE MONOCOUPE: New motor and propeller; licensed. For sale: Scintilla magnetos, Stromberg carburetor and oil pump for Velie. Manvil Larson, 124 Belmont Road, Grand Forks, North Dakota.

### Moth

GIPSY MOTH: Air wheels, air speed, turn-bank, new prop. 105 hours since engine major. Licensed to January 15, 1938. Trades considered. $650. Clyde Cole, Gladstone, Michigan.

### N-B Trainer

BARLING NB-3: Low wing; powered Genet engine. Engine just majored, airplane completely recovered, reupholstered, 3-place. Excellent for training and passenger work. $795. $397.50 down. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

### New Standard

J-5 STANDARD: Licensed, in good condition; landing lights, flares, motor A-1; $1,300. Russell lobe seat pack parachute, $50. Erie Isle Airways, Put in Bay, Ohio.

### Pilgrim

PILGRIM KR-34-B: 3 POLB; Comet 165 engine. Steel propeller, brakes, tailwheel, compass, booster. Ship and engine excellent, covering good. Unusual bargain. Identified. $475. Holland G. Bryan, Court House, Paducah, Kentucky.

### Pitcairn

PITCAIRN OX-5: 40 hours since completely rebuilt; new motor, prop, 30 x 5 wheels, Scintilla; red and silver. Lightest OX biplane, good barnstormer. $450, no trade-in. E. J. DeVore, 2715 Fourteenth St., N. W., Apartment 14, Washington, D. C.

PITCAIRN J6-7: Recovered in 1935. Just relicensed. Absolutely perfect. Extra equipment: Radio, landing lights, electric starter, flares, bank and turn, rate of climb, compass and brakes. All in both cockpits. $1,495. $750 down. Will take trade. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

### Porterfield

TWO 1937 DE LUXE Porterfields: LeBlond 70, Warner 90; steel propeller. Brakes, tailwheel, speed ring, navigation lights, battery, compass, upholstered, special finish. Sell or trade. Finance balance. No reasonable offer refused. Edgar Smith, 3312 Olive, Kansas City, Missouri.

PORTERFIELD: LeBlond 70. Demonstrator; special finish, speed ring, and many other extras. Must sell. Price only $1,200. Aero-Ways, Inc., Cleveland Airport, Cleveland, Ohio.

### Rearwin

REARWIN: 70 LeBlond. Built 1935. Extra equipment. 295 hours since new. Absolutely perfect. $1,495. $750 down. Will take trade. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

REARWIN: LeBlond 70; motor just majored; Grimes landing lights; late 1935; $1,375. $700 down. DePonti Aviation Co., Minneapolis, Minnesota.

1936 REARWIN SPORTSTER: LeBlond 70; brakes, speed ring, heater, navigation lights; never damaged; motor excellent. For immediate sale at $1,495. Earl Kail, McKinley Airport, Canton, Ohio.

### Ryan

RYAN S-T: Never cracked. Total time on engine and ship, 220 hours. Dual control and brakes. Bank and turn. Private owner. Will show Curtiss-Wright, Baltimore, Md. H. Riall Jackson, Commerce Building, Baltimore, Maryland.

RYAN B-5: Land or seaplane with floats. Licensed until October 1st; full equipped. Ship has approximately 1500 hours; motor approximately 500 hours. David J. Powers, Eagle, Wisconsin.

B-1 Ryan J-5: Cabin monoplane, 5-place, excellent condition; full of extras. Licensed to September 1937. $975. May consider trade or finance. Fred Rigler, 1049 Lincoln Place, Brooklyn, New York.

### Savoia-Marchetti

SAVOIA MARCHETTI: Steel prop, starter; perfect condition; $1,400. $700 down. DePonti Aviation Co., Minneapolis, Minnesota.

### Star

STAR CAVALIER: Lambert; licensed; air speed, compass, rubber motor mount; engine and ship in practically new condition. $850. Stevenson-Weeks, Municipal Airport, Kansas City, Missouri.

STAR CAVALIER: Lambert; licensed; air speed, compass, rubber motor mount; engine and ship in practically new condition. $850. Stevenson-Weeks, Municipal Airport, Kansas City, Missouri.

### States

STATES: Rover 75 hp. Newly recovered, upholstered; has airwheels. 50 hours since major. $715. Consider ship needing recovering or repair in trade. Also used Rover parts for sale. Simon Smith, R. 5, Box 161, Beloit, Wisconsin.

STATES MONOPLANE: 125 Kinner. 110 hours total. Metal propeller, tail wheel. Just relicensed. In fine condition. $1,190. Inter City Airlines, Boston Municipal Airport, Boston, Massachusetts.

### Stearman

STEARMAN: Wasp Jr. New covering; complete blind flying instruments; radio, transmitter, lights, electric starter, generator, starter, speed ring. $2,750. Trades considered. Aero-Ways, Inc., Cleveland Airport, Cleveland, Ohio.

LATE C-3-R STEARMAN: J-6-7-D engine; total time 700 hours; 180 hours on motor since major at factory; fabric perfect, white and gold; nicely upholstered; Heywood starter, landing lights, bank and turn, rate of climb, compass, semi-air wheels, pants, Townend ring and tail wheel. $1,600. Will consider trade. Andy Stinis, Floyd Bennett Field, Brooklyn, N. Y.

### Stinson

TRIMOTORED STINSON Airliner: Model SM-6000-B. 11-place. Complete equipment. Reasonable. N. D. Butler, 1140 Twentieth Street, N. W., Washington, D C.

1935 SR-6: Privately owned Stinson Reliant; NC-15122, $5,885; cost nearly $9,000 with extras, including standard instruments plus Kollsman sensitive altimeter, Smith controllable propeller, 100-gallon tanks, flares, landing lights, R C A radio, turn and bank; red and cream finish with matching red leather upholstery; purchased new from Stinson September 1935; never cracked. Flown by one pilot only; maintained without regard for cost; used for personal travel only. M. Reynolds, 542 S. Dearborn Street, Chicago, Illinois.

STINSON RELIANT 1933: Condition excellent. Equipment includes radio, turn and bank, rate of climb, landing lights, flares, 70-gallon tanks, original logs; 200 hours since complete major overhaul. $2,850. Air Service, Inc., New Castle, Delaware.

KINNER STINSON: With Hamilton propeller, Heywood starter, turn and bank, air speed, brakes, duals, blue plush upholstery; privately owned. Licensed to September 1937. $800. Edward Botine, Pocahontas, Iowa.

STINSON SM8A: Excellent condition. No time since motor overhaul. Navigation and landing lights. A real buy at $1,375. Ephie Hull, Austin, Minnesota.

WARNER STINSON: Motor excellent, steel prop; fuselage recovered. Special paint job. Just relicensed. Wonderful performer. Will trade. Harry Deuter, 318 W. Washington, Fort Wayne, Indiana.

STINSON JR. SM8A: Lycoming, 4-place cabin. Licensed till October 15th. Good condition throughout. Motor has forged pistons and heavy duty crankshaft. Direct electric starter, bank and turn, rate of climb, retractable landing lights; $1,150. Terms. Norton Air Service, Inc., Norton Field, Columbus, Ohio.

STINSON SM8A: Motor just majored, forged pistons, heavy duty crankshaft, etc. Ship completely recovered and upholstered. 8.50 tires. Must be seen. Bargain. Columbia Airways, Bloomsburg, Penna.

STINSON S: $800 down; just reconditioned; many extras. Stinson SM8A, only $500 down. Stinson Reliant, $1,200 down. For values see Pioneer Aviation, Airport, Syracuse, New York.

PRIVATELY OWNED 8-A Stinson: Donut tires. Best buy in the world. $1,550. J. E. Blythe, 1108 East Admiral, Tulsa, Oklahoma.

STINSON 1934: Privately owned; Smith controllable propeller, flaps, rate of climb, turn and bank, carburetor air temperature, manifold pressure, thermocouple, compass, clock, RCA radio, landing lights, flares, brand new cactus-proof tires, 75-gallon tanks, genuine leather upholstery; flown 325 hours; engine just majored; no time since. Write owner care AERO DIGEST, Box 2572.

STINSON T TRIMOTOR Airliner: Night flying equipment, bank and turn, electric starter, 10-place cabin; licensed to June; complete barnstorming equipment, geared gas pump, oleo air pump, metal bottom under fuselage, spare landing wheel and tire, spare tail wheel assembly, public address system, four speakers. Priced at $1,890. J. Lee Wolke, 901 W. Chambers Street, Jacksonville, Illinois.

STINSON "S": Just relicensed. Color black and silver. Fabric and engine good condition. New wing installed, new flares, landing lights, bank and turn, rate of climb, earth inductor compass, other extras. $1,625. John Abiuso, Airport, Sunbury, Penna.

STINSON SM8A: Perfect condition throughout; high lustre black and red finish; cabin just reupholstered in red leather; new crackle-finish instrument board with complete blind flying instruments. Landing lights, flares, radio. Exceptionally smooth Lycoming. Semi-airwheels; brakes, etc. $1,550. Demorr Aeronautical Corporation, Paoli, Pennsylvania.

J6-7 STINSON: Just completely recovered and newly upholstered. Engine just majored and modernized. An unusual buy in an airplane in perfect condition. $1,495. $875 down. Will take trade. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

TRIMOTORED STINSON Airliner: Complete night and blind flying equipment; radio, electric starters. Licensed to August, 1937. $2,650. Will finance or take trade. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

SPECIAL STINSON Model R: Airplane built specially for executive use with down cushions, high-back reclining rear seats, whipcord upholstery. Total time 540 hours; 200 hours since engine major overhauled by Lycoming service station; retractable landing lights, bonding, shielding and Lear radio. 75-gallon gas tanks; beautiful rubbed finish of red with gray contrast. Price, $2,000 cash. G. D. Owsley, Glenview, Illinois.

STINSON 1934 SR-5: With flaps. Total time 300 hours. Privately owned. Olive with orange stripe. Turn and bank, rate of climb, radio, navigating and landing lights, compass. Like new, never cracked. $3,650. Will finance. Dr. Harold W. Trott, Hemlock, New York.

STINSON 4-PLACE: $850. Hand-rubbed finish. Plane and Warner motor just relicensed. Single place Aeronca or your automobile traded. Stitt Motor Co., 1001 Bladensburg Road, Bladensburg, Maryland.

STINSON RELIANT: '33 model, completely bonded, shielded for radio. Radio receiver installed. Also fully equipped for night flying. Excellent condition. Terms. Edw. A. Forner, Jackson, Michigan.

STINSON: 4 PCLM with or less motor. Perfect condition; gloss finish; fast, ready to fly anywhere. Trade considered. Must sell first reasonable offer. 10 Willard, Montclair, New Jersey.

STINSON SM8A: Perfect condition; ring, semi-airwheels, heavy landing gear; $1,375. $700 down. DePonti Aviation Co., Minneapolis, Minnesota.

$750 DOWN BUYS 330 hp six-place cabin Stinson; starter, new airwheels and brakes. Small amount of time since major overhaul. Excellent condition. Accept light car or airplane part of down payment. Balance financed. Central Air Service, Inc., Grand Rapids, Michigan.

STINSON SR-6: Flaps; 100-gallon tanks, Lear receiver, transmitter and compass; landing lights, flares; cylinder, carburetor and manifold pressure gauges; bank and turn, rate of climb, Kollsman, directional gyro. Sperry horizon, starter, generator, Smith controllable; special paint, blue leather; 185 hours total. $5,500. Walz Corporation, Central Airport, Camden, New Jersey.

STINSON SM8A: Lycoming; relicensed January. Semi-airwheels, retractable landing lights, new battery, new upholstery. Priced to sell. D. Young, 311 North 36th Avenue, Omaha, Nebraska.

### Swallow

SWALLOW TP: Repainted, motor majored; instruments rear cockpit; fuselage faired and ship entirely gone over; $300. Lewis Holy Name School of Aeronautics, Lockport, Illinois.

### Travel Air

FINEST OXX-6 Travel Air 2000 in the country: Licensed till April 1938. Motor and ship in A-1 condition. Detachable motor mount. Silver wings, blue fuselage. $465. Edward A. Zoeller, 15 Chelsea Road, Clifton, New Jersey.

TRAVEL AIR 2000'S: Licensed; one completely rebuilt, hand-rubbed finish, new 30 x 5 wheels, brakes, compass, etc. New motor. $625. One licensed to August; perfect condition, motor just top overhauled, Miller overhead, new prop, wheels, tires, and windshield; neat paint job; $450 cash. Edgar Maiscott, South Charleston, West Virginia.

TRAVEL AIR HISSO 180 hp: Total time 340 hours, ship and motor. Good condition. Black and orange. Steel prop, detachable motor mount; high performance. Licensed until August. $475. Edward W. Cochran, 69 Bogman Street, Providence, R. I.

TRAVEL AIR S-6000-B: Wright J6-9 330 hp; 6-place; motor just majored; licensed till December 15th. Real performer and in A-1 condition throughout. $1,695; terms. Norton Air Service, Inc., Norton Field, Columbus, Ohio.

TRAVEL AIR OX-5: New motor, new covering; airwheels, new propeller. Finest OX job in country. Must be seen. Bargain. Columbia Airways, Bloomsburg, Pennsylvania.

TRAVEL AIR J-5: Completely overhauled, new covering; custom finished in blue and silver. Airwheels, brakes, tail wheel. Trades considered. $1,350. Aero-Ways, Inc., Cleveland Airport, Cleveland, Ohio.

J-5 TRAVEL AIR: 3-place open. Condition guaranteed perfect. Just majored throughout. Will finance. Overhauled J-5 motor, $420. Used J-5 parts very cheap. R. C. Downing, Ferguson, Missouri.

J6-5 TRAVEL AIR E-4000: Excellent condition. Completely rebuilt and licensed to August, 1937. Never flown since licensing. Always hangared. Striking paint job Pressure of business forces owner to sell. Will consider cabin cruiser or late model auto in trade. Price, $1,425. Kenneth Fletcher, Framingham, Massachusetts.

FOR SALE: Travel Air OX-5. New motor, ship in perfect condition. Black fuselage, gold wings. Licensed to November, 1937. Fly away, $600. Ship at Mt. Hawley Airport, Peoria, Ill. Write or wire Leo Jackson, Hamilton Hotel, Bloomington, Illinois.

TRAVEL AIR: Wright 175; never cracked; just majored; cruises 8 gallons an hour; adjustable steel propeller, brakes, tail wheel, landing lights, excellent mechanical condition. Must sacrifice at once, including full set of special Wright tools. $1,150. Mary Kerr, 129 DeWitt St., Syracuse, New York.

### Verville

VERVILLE CABIN SHIP: J6-7, just majored; relicensed. Clean, glossy finish. Night equipment. Real buy. Goes to best offer over $995. Buck, 409 N. Francis, Madison, Wisconsin.

### Viking

VIKING KITTY HAWK: K-5 motor, completely majored, motor top overhaul. Also K-5 parts, mags, carburetor, cylinders, connecting rod assembly. Plane $900. Parts cheap. S. L. Gulick, Aldie, Virginia.

### Waco

WACO 10 GXE: OX; just recovered; wings gold leaf, fuselage red; motor 75 hours since Army overhaul; knocked down in storage now. $250. S. Sudduth, Police Dept., Lexington, Ky.

WACO F WARNER: Steel prop, Heywood starter; fuselage just recovered; wings and tail group sprayed; spars reinforced with plywood. License expires March 1938. Priced for quick sale. Erich Paselk, 6434 Cottage Grove Avenue, Chicago, Illinois.

SIEMENS WACO 10: Perfect condition. Bendix wheels and brakes, Hamilton standard prop. Highest cash offer takes. L. H. Caraher, 7100 South Shore Drive, Chicago, Illinois.

WACO CABIN 1934: 210 Continental, excellent condition; painted Waco Red; full set of instruments, landing lights, flares, 6 hours since majored. For quick sale, $2,900. Pictures on request. Price Coomer, 924 Dayton Avenue, Lexington, Kentucky.

1934 WACO CABIN: Jacobs. Modernized. Instruments include Sperry group. Radio, night equipped. Extra tanks. Morocco leather interior. Excellent finish. $3,650. Inter City Airlines, Boston Municipal Airport, Boston, Massachusetts.

WACO F-5: 225 hp Jacobs; lights, flares, pants, radio shielding, blind flying instruments, beautiful finish; perfect. Also 210 hp Waco F-2. Paul Peterson, 2503 Union Avenue, Altoona, Pennsylvania.

WACO J6-5: 3-place open BSO. Perfect condition; airwheels, brakes, bargain; motor just had $400 major. Wilbur Horn, 3566 Cedarbrook Road, Cleveland Heights, Ohio.

**WACO "10":** New license, Millerized motor, $325. Newly recovered Waco "10", $250 down. Warner Waco "F", $600 down. For values see Pioneer Aviation, Airport, Syracuse, New York.

**1935 WACO CUSTOM CABIN:** With 285 Wright and Hamilton Standard controllable pitch propeller; 280 hours; perfect condition; all standard instruments plus directional gyro, bank and turn, rate of climb, sensitive altimeter, manifold pressure, clock, outside air and head temperature gauges; RCA receiver; landing light, flares, and 55-gallon gas capacity; beautifully upholstered with the finest Goodall-Sanford plush. Price, $5,500. Goodall Company, Cincinnati, Ohio.

**WACO F-2:** 170 Jacobs; good condition, $1,750. Waco Straightwing, Wright J6-5, excellent throughout, $1,400. Trades considered with cash difference. Lytle, 2333 Vodeli St., Pittsburgh, Pennsylvania.

**FOR SALE OR TRADE:** OX-5 Waco; licenseable. 4-place center wing cabin, with Challenger motor; cracked, cheap. Wanted: OX-5 motor, Miller top action; Aeronca, Cub, Waco or Travel Air for Challenger. E. A. Sark, 988 East 152nd St., Cleveland, Ohio.

**FOR SALE, WACOS:** 1935 Standard cabin, Continental 210, 275 hours, excellent condition, $3,500. F-3, Continental 210, like new, 195 hours, $3,500. F-2 Continental 165, equipped for blind flying, $1,750. J-5 Taperwing, 136 hours since major, wings need recovering, $850. Can finance. Hardy Young, Municipal Airport, Oklahoma City, Oklahoma.

**WACO J6-5 STRAIGHTWING:** Motor modernized; ship recovered and just relicensed. Ideal ship for private owner or passenger hopping. Boulevard Airport, Roosevelt Blvd., Philadelphia, Pennsylvania.

**WACO F-2:** Continental 165; completely recovered; Berryloid hand rubbed finish, special color combination. Engine excellent condition, steel propeller like new; standard instruments, ring starter, military windshield, etc. $1,850. John Abiuso, Airport, Sunbury, Pennsylvania.

**WACO GXE:** Licensed to January, 1938. New Scintilla magnetos. Fabric perfect. $475. $275 down. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

**WACO F:** Warner powered. Ten hours on engine since major. Licensed to next September. A real buy. $1,295. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

**WACO F:** Kinner K-5. Just relicensed. 80 hours since major on engine. An excellent and economical passenger carrying ship. $1,195. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

**WACO J-5 STRAIGHTWING:** Hand-rubbed, high gloss finish in yellow. Absolutely perfect condition. 29 hours on motor since major. $1,395. $700 down. Will take trade. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

**WACO C:** Late 1931. Continental 165 hp motor, majored 140 hours ago. Topped 40 hours. Recover work just completed. New compass, semi-air wheels, navigating and landing lights. $1,750. Will finance. Aviation Finance Co., Hemlock, New York.

**WACO CUSTOM CABIN:** Wright 285 hp. Extras include Hamilton Standard controllable propeller, generator, bank and turn, rate of climb, lights, flares, RCA receiver, RCA transmitter, leather upholstering, wheel pants, thermocouple; finished in white fuselage, red wings; trimmed in blue. Very attractive. Good condition throughout. A real bargain. The H. C. Robbins Company, Cleveland, Airport, Cleveland, Ohio.

**WACO 9 OXX-6:** In A-1 condition; color, red and silver; fabric good. Sacrifice for quick sale, $200. Jennings Bros., Grafton-Worcester Airport, North Grafton, Massachusetts.

**WACO "C":** '32, Continental. Licensed to October 1937. Excellent condition and history. A rare buy at $2,000. AERO DIGEST, Box 2583.

**WACO 10:** OX-5. Covering perfect; $425. $225 down. DePonti Aviation Co., Minneapolis, Minn.

**WACO:** 1932 cabin, perfect condition throughout; Heywood starter; standard instruments; total time on airplane 815 hours; engine 875 hours; since overhaul, 20:00 hours. Finance 50%. John T. Corrodi, Inc., Box 185, Bexley Station Columbus, Ohio.

**WARNER WACO F:** Completely reconditioned; motor just majored; extra slick cover job. We have two open ships and only need one. Will consider trade for smaller job. Burnham-Miller Flying Service, Muny Airport, Omaha, Nebraska.

**WACO F:** Kinner B-5. Five new heads; Heywood starter; black with red wings; relicensed August. 450 hours. $1,450. Central Aeronautical Corp., Municipal Airport, Indianapolis, Ind.

**FOR SALE:** Waco A, 170 Jacobs. Total time 500 hours; since major, 150 hours. Perfect condition. License to June 1st. $1,500 cash. W. B. Sheffield, Americus, Georgia.

## *Wallace*

**WALLACE B:** 330; 3PCLM. Kinner K-5, all heads reinforced. Fahlin prop. Consolidated panel; air speed; Bendix wheels, brakes, tail wheel. Folding wings. Good shape. NC license. $550 cash; no trades. Waco 10 landing gear parts. Foster Adams, 1613 Johnson Street, LaCrosse, Wisconsin.

## *Special Jobs*

**POBJOY RACER:** Nicholas-Beazley R, restricted R1W. World record holder in class. New prop, cowling, pants, enclosure. Lewis Holy Name School of Aeronautics, Lockport, Illinois.

**"BABY BELLANCA":** Warner 125; brakes, speed ring, steel prop. Two-place tandem cabin in perfect condition; must sell on account of illness; $600 or best offer. W. L. Chamberlain, Rochester, Indiana.

**HOWARD RACER:** 200 mph. Just the plane for sport, racing or stunt flying. A real buy at $1,100. Harold Neumann, 2714 W. 51st Street, Kansas City, Kansas.

## *Miscellaneous Aircraft*

**STINSON SM8A:** 197 hours since major by Lycoming; total 518. Full Goodyear Airwheels, new type brakes and roller bearings. Rate climb, bank turn, leather upholstery, rear vision mirror. Covers and paint like new. Speed ring, starter, lights. Ship in wonderful shape. Orange and black. Fairchild 22; Rover: Total 465 hours. 146 since major. Repainted and rubbed. International orange, cream wings. New tires, tail wheel. Standard instruments. Looks and flies like new. Wired for lights. Will consider trading both ships for Stinson Reliant. R. D. Apperson, Box 21, Lynchburg, Virginia.

**PLANES FOR SALE:** Laird Speedwing, Wright 330; Laird Whirlwind, Wright J-6 300; Laird Whirlwind, Wright J-5 220; Laird Speedwing Jr., Ranger 120; Buhl 2-place trainer, Wright J-5. Send for complete list of used planes. E. M. Laird Airplane Company, 5917 S. Cicero Avenue, Chicago, Illinois.

**RYAN J-5:** Completely rebuilt, finest materials used; streamlined, very fast; never cracked; speed ring; engine topped; cruises 115; absolutely perfect, $1,400. Cessna J6-7: Starter, duals, extra nice, $1,850. Stinson "R," Lycoming: Condition perfect, extra good engine; landing lights, duals, starter, heater, rare bargain, $1,900. Robin Challenger: Fourplace; wings recovered; good condition; engine O. K., $1,000. Travel Air OX-5: Best performing OX job we ever owned. Fly hands off. Millerized: $550. Northern Oklahoma Flying Service, Blackwell, Oklahoma.

**WACO TEN:** Never cracked, new cover on fuselage; priced for quick sale. Lincoln Page OXX-6: Dandy, original cover, never damaged. American Eagle, Model 201: Kinner K-5, steel prop, brakes, turn and bank, other extras. Will take new or good used cars in trade. Two Model A Hisso motors, new OX-5 in original crate; one overhauled OX-5. Parts for A-70 Continental. Blosser Motor Company, Concordia, Kansas.

**WACO J-5 STRAIGHTWING;** Challenger Rearwin; Challenger Robin; J6-7 Cessna; Curtis Fledgling; late '36 Cub; C-3 Aeronca. L. B. Sherrick, McKinley Airport, Canton, Ohio.

**WACO F WARNER:** $1,250. Stinson R, $1,990. Witch Duck Aeroplane Corp., 248 Bank Street, Norfolk, Virginia.

**JACOBS CUSTOM-BUILT Waco:** Radio, blind and night flying equipment, Standard Steel prop. Exceptional buy at $3,600. J6-5 Robin, slightly damaged, $950. Low wing Aeronca 90, less than 200 hours, $2,100. C-3 Aeronca 1936, $950. C-3 Aeronca 1935, $850. OX Robin, excellent condition. $495. OX Fairchild, damaged lower wings, $200. Ryan B-1, Waco 10, Buhl Airsedan, wings and parts. Huntington-Ironton-Chesapeake Airport, Aeronca Distributors, Box 91, Chesapeake, Ohio; Box 91, Huntington, West Virginia.

**1934 AERONCA C-3:** E-113-C engine; good condition; price, $750. Velie Coupe, good cover, semi-air-wheels and brakes. Inter-City Flying Service, Fort Wayne, Indiana.

**WACO 9:** New covering, prop and wings. Motor in good condition. American Eaglet in good condition, motor overhauled. Will take late Terraplane or Chevrolet on Waco. Miles Vandergrift, Austin, Minnesota.

**CESSNA:** 1936 Model C-34. One of the last '36 models built. Perfect condition; less than 100 hours. Travel Air biplane: Model 4000, Challenger. Motor and cover in perfect condition. Less than 600 hours total time; 80 hours since major on motor. Frieze ailerons. Bargain at $1,250. Travel Air: 4-place monoplane, J6-7 modernized motor. Less than 750 hours total time; very few hours since motor major. Bargain at $1,600. Beechcraft: J6-7 motor. Ship in perfect condition; complete blind flying equipment, including 2-way radio and directional gyro. Cost over $15,000; our price, $6,500. Cessna Aircraft Company, Wichita, Kansas.

**FOR SALE:** Stinson U trimotor, formerly American Airlines, price, $2,500. Also, 1934 Stinson single motor, with flaps, flares, radio, directional gyro, artificial horizon and Hamilton controllable pitch propeller. 15 hours since major overhaul; price, $3,400. One Hamilton 7-place all metal airplane; ship and motor just major overhauled. Price for one Lycoming 240 hp motor, completely overhauled, $1,000. Bluebird Air Service, Municipal Airport, Chicago, Illinois.

**2000 TRAVEL AIR:** Reconditioned, relicensed, $550. Motor majored. OX Robin: Always hangared, never cracked; $550. Total 300 hours. Answering buyers only. Parks Watson, Blue Ash, Ohio.

**CURTISS-WRIGHT SEDAN:** 185 hp Challenger; 4PCLM; electric starter, $1,050. OX-5 Eaglerock A-2, fine, $375. OX-5 motor, just overhauled, $35. Skis. G. O. Imm, Fergus Falls, Minn.

**INLAND SPORT:** High wing monoplane, side-by-side; LeBlond 70; excellent condition. Licensed November, 1937. $725. Driggs Rover, $975. A. E. Hultzen, 843 N. Pine Ave., Chicago, Ill.

**LYCOMING STINSON SM8A:** Just relicensed; ship and motor first class condition. $1,375. 3-place Kinner Eagle, licensed, $475. Tex LaGrone, Municipal Airport, Kansas City, Missouri.

**J-2 CUBS:** Series 4, Continentals, three and five months old. Model 7 Fleet, recovered. LeBlond 8500 Rearwin: Many extras, cannot be told from new. Five months old. J6-7 Travel Air biplane; speed ring, wheel pants, wing fairings, very fast and speed looking. J-5 six-place Stinson, recently recovered. Stinson U trimotor, radio and many extras. All airplanes priced to sell and in excellent condition. If interested, come and see same. Akron Airways, Inc., Airport, Akron, Ohio.

**SPORTPLANES $55 UP:** OX jobs, $95 up. Terms. New Spring Directory, just out, with owner's price, name and address; 25c postpaid. Used Aircraft Directory, Athens, Ohio.

**EAGLEROCK J-5:** 45 hours since overhaul and refinish; engine overhauled, late type gears installed; Hamilton prop, full airwheels, pneumatic struts, long headrest, Pioneer instruments on special panel, approved lights; finished black and yellow diagonally; beautiful ship. Excellent for any purpose; licensed. $1,000 cash, no less. Trade 3-4 place cabin. W. Lehtio, 19715 Coventry, Detroit, Michigan. Townsend 7-8073.

**TRAVEL AIR 6000:** 7-place, J6-9 engine, just overhauled and run in at Northwest Airlines shop. Tail group modernized and recovered; landing gear and tail wheel assembly overhauled; landing lights, flares, new tires. Ship in perfect flying condition and licensed until February, 1938. Selling to settle estate, $1,900. Tank Robin in excellent condition, $650. OX Eagle, exceptionally good condition throughout; practically no time on engine, $350. Damaged 125 hp Menasco Pirate and steel prop, $150. Mel Swanson, Minneapolis Airport, Minneapolis, Minnesota.

**WACO GXE:** Tank No. 63 engine. Excellent condition. 494 hours total time. Engine 300 hours. Aeronca C-3, E-113-A motor. Ship just completely rebuilt and relicensed. No time since. Total time. 1015 hours. Demorr Aeronautical Corporation, Paoli, Pennsylvania.

**REPOSSESSED** Cubs, Ryan B-1, Travel Air 150 hp biplane, Wallace, Waco C, Kinner Bird, Aeroncas, OX Eaglerock, Cunningham-Hall and 1934 Stinson airplanes. Continental A-40-2, Cirrus Mark III and II, Salmson 9-cylinder and Lycoming motors, just majored. Airplane parts for Cubs, Stinson Reliant, Moths, Avians, Klemms and American Eagles. Also 16-stud Kinner cylinders and steel propellers and parts. Airplanes sold small down payment, balance monthly. Parts and motors completely financed. Aviation Finance Co., Hemlock, New York.

OX-5 WACO, $325. OX-5 Pheasant, $375. OX-5 Waco, $475. OX-5 Swallow, $495. Stearman, Waco F, J-5 Travel Air, Porterfield, Taylor Cub and many others. Write today. Aero-Ways, Inc., Cleveland Airport, Cleveland, Ohio.

20 CERTIFIED and reconditioned airplanes for sale or exchange: J-4 220 hp Straightwing Waco; Warner 145 hp Monocoupe, late model; J-5 Speedwing Travel Air; B-5 330 hp 6-place Ryan; J-5 220 hp 3-place Laird; J6-9 330 hp 6-place Stinson; PA-8 Pitcairn Mailwing, less 330 hp motor; 2 OX-5 Waco 90's; 2 OX-5 Travel Airs; Lycoming-powered Stinson Jr., equipped for night flying, includes radio; J6-7 250 hp 3-place Travel Air; J6-9 330 hp 6-place Travel Air; OX-5 Robin; J-5 6-place Stinson; OX-5 Laird; J-5 220 hp Straightwing Waco. Late model cars accepted. Deals financed. Becker-Forner Flying Service, Inc., Jackson, Michigan.

REPOSSESSED B-1 Ryan cabin ship less motor; price, $450. Repossessed J-5 6-place Stinson cabin ship; price, $550. Repossessed 330 hp Stinson, with or without motor. Make offer with or without motor. Bargain prices. Edw. A. Forner, Jackson, Michigan.

GIPSY MOTH: With new motor and prop. Reinforced landing gear, slots, compass, spare motor. Plane in excellent condition; $800. Will trade for 1936 Taylor Cub. Kinner K-5 motor, less two heads and valves. New Standard sport trainer, Kinner B-5 with ring, air starter, blind flying, brakes, military windshield, extra tank; ship in perfect condition; $1,200. George Schaaf, 141 Wilson Avenue, Eltingville, Staten Island, New York.

STINSON SR6B: Late 1935; controllable pitch propeller, Kollsman sensitive altimeter, bonded and shielded, 75-gallon tanks; total time 140 hours; $4,500. Monocoupe D-145: Powered with 145 hp Warner. Electric starter, pants, NACA cowling; licensed February, 1938; total time 240 hours; $1,950. Fleet Model 1: Powered with 125 Warner, $1,000. Stinson SR8B demonstrator; many extras including night flying equipment. Lycoming and LeBlond engine parts. Sioux Skyways, Sioux Falls, S. D.

FOR SALE: Waco F Warner in A-1 condition; licensed to April 15, 1938. Will trade for cabin job or sell for $1,500. Rising Sun Airport, Inc., G Street & Luzerne, Philadelphia, Penna.

FOR SALE OR EXCHANGE: Two Wright J6-9 Stinson, 6-place. Two Driggs Skylarks, one nearly new. Two J-5 Travel Airs. J-5 Waco. Challenger Robin with air starter, new airwheels, new covering. Taylor Cub. Aeronca C-3. Two OX-5 Eaglerocks. Can finance up to 50%. Automobiles or airplanes accepted in trade. Write for details. Central Air Service, Inc., Grand Rapids, Michigan.

440 WRIGHT BEECHCRAFT: 1936 145 Warner Fairchild, on pontoons; new Rearwin, 90 LeBlond; '34 and '33 Stinson Reliants; Bellanca Skyrocket; '36 Lambert Monocoupe demonstrator; '34 Waco cabin; J6-7 Travel Air; SM8A Stinson. Aircraft Sales Co., Hangar D, Roosevelt Field, Mineola, N. Y.

KINNER BIRD: $850. Aeromarine Klemm seaplane, $800. Great Lakes, $825. Challenger Command-Aire, $1,000. Challenger Travel Air, $1,000. Millerized OX Robin, $490. Waco UIC: radio, ambulance, etc.; $3,200. Eaglet, $390. Trades and terms. Wasp, Challenger, J-5, A-40-4 parts. Airways, Inc., Waterville Municipal Airport, Waterville, Maine.

1936 RANGER-powered Fairchild 24 demonstrator: Guaranteed perfect; 120 hours; bargain for quick sale. 1934 Wright-powered de luxe Waco Cabin. Completely recovered, refinished and majored; many extras and full night flying equipment; price on request. 1935 Warner-powered Fairchild 24: Radio receiver, bank and turn, generator; in excellent condition; $2,950. Late 1935 Warner-powered Fairchild 24: All yellow; bank and turn, rate of climb; guaranteed perfect; bargain for cash. 3-place OX Travel Air: Good shape; steel prop; $450. 3-place Warner-powered Ranger airplane; excellent condition; $750. Calling All Dealers: Exceptional opportunity on Taylorcraft dealerships. Air Activities, Inc., Municipal Airport, Houston, Texas.

## ENGINES

FOR SALE: Lycoming R-680 used engine parts in good condition, including base and crankshaft. Will buy used engines. Norman Peters, 2425 Chase Street, Toledo, Ohio.

BRAND NEW Axelson 150: Never uncrated, $675. Kinner 160 low total hours, just overhauled, $425. Steel propeller, $50. Air starter, $75. Kenneth Wise, 4618 Grove, Oakland, Calif.

WASP C ENGINE: 7 to 1 blower, bonded and shielded, forged pistons, KE valves; no time since major overhaul. $975. Mid-West Aviation Corporation, Norton Field, Columbus, Ohio.

LYCOMING R-680: Complete with mags, carburetor, heavy duty crankshaft and forged pistons. 400 hours since majored. $395. Howard Sauls, Saltville, Va.

LE BLOND 85: 350 hours; 50 since major. Complete with Hamilton Standard steel propeller, $300 f.o.b. Tucson. J. D. Church, Bureau of Reclamation, Yuma, Arizona.

FOR SALE: Warner 125 hp engine with steel prop. Never damaged; being replaced with higher horsepower engine. Air Activities, Inc., Municipal Airport, Houston, Texas.

SZEKELY 45: Scintilla mags. 35 hours since $75 factory major. Including prop hub, for quick sale, $100. Bob Cooper, 223 Wiggins, West Lafayette, Indiana.

SZEKELY MOTOR: 45 hp; new in crate. J-5 motor, total time 429 hours since new; has standard cylinders. Hamilton Steel prop for Lambert 90 hp, practically new. Priced to sell. Sun Batteries, 10521 Gratiot, Detroit, Michigan.

MOTORS! MOTORS! MOTORS! Two J6-9 E-type 330 hp motors; two J-4 220 hp motors; J6-5 175 hp motor; two J6-9 330 D-type motors; LeBlond 70 hp motor, just majored; J-5 220 hp motor. These motors are all in running condition and priced to sell. Starters and propellers for above motors if desired. Also slew of motors and aircraft parts at closing-out prices. Michigan Aero Motors, Jackson, Michigan.

KINNER K-5 front exhaust. Guarantee no time since complete major. $395. Can finance by taking lien on ship motor is installed in. "Al" Leeward, New Kensington, Pennsylvania.

WRIGHT 320 HP: 7-cylinder, Serial 760-B2. 350 hp at take-off; including carburetor, exhaust, direct cranking electric starter, 15-amp generator and drive assembly, ignition switch. Total time, 190 hours; no time since engine completely overhauled, run in and tested at Wright factory. Price, $3,500. Also Hamilton two-way controllable pitch propeller, belonging to above engine, just inspected and overhauled; condition equal to new. Price, $750. Christopher Georgieff, care Leech Aircraft, Roosevelt Field, Mineola, N. Y.

LYCOMING R-680-BA: 240 hp; completely overhauled and tested. Equipped with direct electric starter, carburetor, magneto, adjustable pitch propeller; $1,000. General Airmotive Corporation, Municipal Airport, Cleveland, Ohio.

## WANTED TO BUY OR TRADE

WANTED: One Lambert 90, one Velie 65 motor. One 2- or 3-cylinder around 40 hp motor. One set airwheels, 20x9-4, 1½-inch spindle. Owen's Garage, Sherwood, North Dakota.

1936 REO SEDAN and factory built house trailer, accommodates four. Both perfect. Trade or down payment on ship: three-place open biplane, complete instruments, blind flying; late J6-5, J-5. Photos exchanged. AERO DIGEST, Box 2553.

HAVE $500 CASH for biplane or cabin plane in good condition. Must be licensed. Air-cooled job preferred. John Syrotiuk, R. D. No. 6, North Street, Auburn, New York.

SEEKING USED PONTOONS for 145 Warner Fairchild 24. Cash for same if satisfactory. Prefer Edo 2425 with water rudders. AERO DIGEST, Box 2554.

WANTED: Warner Scarab or LeBlond 7DF in good condition, reasonably priced. Also speed ring and exhaust collector. E. H. Fletcher, 2807 Eighteenth Avenue So., Seattle, Washington.

WANTED: Steel hangars, any size; give details. Have Waco GXE landing gear and tail group, also J-2 Cub wings and tail group for sale. Al Young, R. D. 4, Johnstown, Pennsylvania.

CADILLAC SEDAN to trade for light ship or good OX. Give full information in first letter. George Wells, 354 W. Cambridge, Alliance, Ohio.

WANTED FOR $350. Licensed airplane. Furnish photo, all details, first letter. List instruments, age fabric, whether checked or patched. Herman, 918 Denison, Little Rock, Arkansas.

GLIDER WANTED: A utility glider in good shape, preferably Franklin. R. L. Thoren, 632 Church Street, Ann Arbor, Michigan.

CURTISS JR. WANTED: Licensed or identified. Consider slight crackup. Must have terms. State condition. David Jameson, Rock House, Pulaski, Virginia.

WANTED: Good Switlik or Irving white silk parachute for cash. Must be perfect. Also separate harness for emergency chute. George Peterson, Ginter, Clearfield Co., Pennsylvania.

WANTED: Autogiro, to barnstorm with Ford Trimotor; field rent and advertising furnished. O. K. Southwick, R. F. D. 1, Box 836, Springfield, Missouri.

WANTED: 850 x 10 tires; set of three 1¼ minute flares; and for sale: Lycoming engine and Model 3300 Edo floats. Leithold, Municipal Airport, St. Paul, Minnesota.

AIRPLANE WANTED: Light two-place ship, '35 or '36. Must be licensed. Prefer Cub or Aeronca. Give full particulars and cash price in first letter. Box 145, Fowler, Indiana.

WANTED: Fairchild 22 engine cowling, ventilators and baffles; Cirrus inverted rocker pan with felt pad, oil tank, exhaust pipe and propeller. Walz Corporation, Camden, New Jersey.

HAVE $500 and 1930 Ford Coupe, 1935 wheels, Motorola radio, for air-cooled job, licensed. Picture and full particulars in letter. Kelley, 1483 Wayburn, Grosse Pointe, Michigan.

WANTED: Curtiss Junior, repairable, without motor. Must be reasonable. AERO DIGEST, Box 2586.

WANTED: Floats for Aeronca and 4-place Kinner Bird. Red Bank Airport, Red Bank, New Jersey.

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EXPERIENCED airplane mechanic desires job as helper with airline or established commercial enterprise. 13 months' experience; 4 months of airline experience. References exchanged. Private concern. AERO DIGEST, Box 2556.

TRANSPORT PILOT: 21, Instructor's rating, 5 years flying experience. Welding and ground school instructor. Graduate two Approved schools. Married. Desires private or commercial employment. AERO DIGEST, Box 2563.

TRANSPORT PILOT: 1,000 hours; 1-A, 2-A, 3rd radiotelephone; A & E mechanic; experienced on all classes. Age 30. Clean, neat, reliable. Best references from well-known men in aeronautics. Wish position with responsible private or commercial company. Now employed. AERO DIGEST, Box 2564.

TRANSPORT PILOT: 700 hours, 1-A and 2-A ratings; night flying experience. Best of references. Go anywhere. AERO DIGEST, Box 2565.

YOUNG MAN: Aged 20, mechanically inclined, three months experience with barnstormer; wants work with barnstormer or private flier anywhere. Lawrence E. McDonald, Bridgeport, West Virginia.

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MECHANIC: A & E license. Must be single and free to travel and must know Pratt & Whitney engines. Job steady. Give full details and references first letter. AERO DIGEST, Box 2560.

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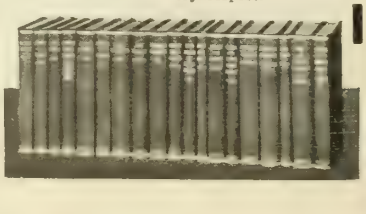
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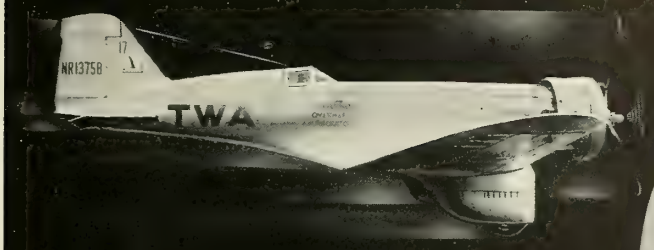
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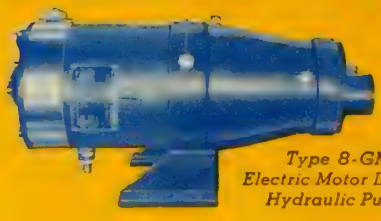
# Eclipse

# HYDRAULIC EQUIPMENT

THE Hydraulic equipment illustrated is representative of the types of units available to the aircraft manufacturer. An Engineering Department experienced in the design, development and manufacture of custom-built Hydraulic equipment is available to cooperate with those requiring assistance in the solution of their Hydraulic problems.

## ENGINE DRIVEN AND ELECTRIC MOTOR DRIVEN HYDRAULIC PUMPS

Eclipse Engine Driven or Electric Motor Driven Hydraulic Pumps available in various capacities to provide a reliable oil pressure source for the hydraulic control of Retractable Landing Gear, Wing Flaps and Retractable Wing Tips or Floats.



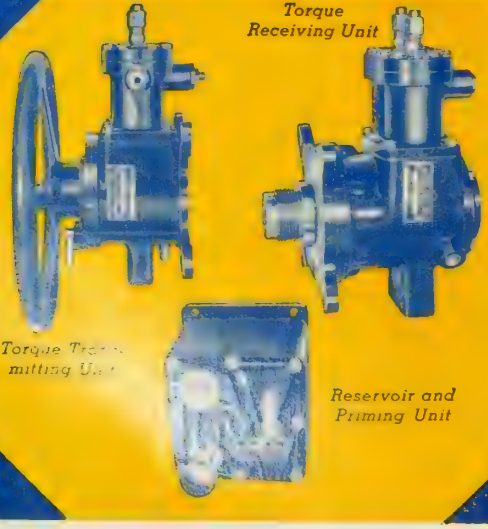
*Type 8-GM Electric Motor Driven Hydraulic Pump*



*Type 5-GS Engine Driven Hydraulic Pump*



*Type 5-GG Engine Driven Hydraulic Pump*



*Torque Receiving Unit*

*Torque Transmitting Unit*

*Reservoir and Priming Unit*

## HYDRAULIC REMOTE CONTROL UNITS

Eclipse Hydraulic Remote Control Units are custom built in accordance with manufacturer's specifications, wherein positive transmission of rotatable or lineal motion without the use of complicated mechanical linkage is desired. Provisions are incorporated in the system for maintaining constant pressure in the lines as well as automatic compensation for expansion and contraction of the fluid.


ECLIPSE AVIATION CORPORATION

*Subsidiary of Bendix Aviation Corporation*

EAST ORANGE, NEW JERSEY

MAY 1937 ★ 35 CENTS

# AERO DIGEST

CLUDING AVIATION ENGINEERING




RD DGA-9 POWERED WITH A 285 HORSEPOWER JACOBS L5 ENGINE

# We Congratulate

## THE ECLIPSE-SERVED

# AMERICAN AIRLINES

## FOR ITS NEWEST ACHIEVEMENT:




ON February, American Airlines, Inc., rounded another pylon in air history carrying its 1,000,000th commercial passenger! First airline of the nation to attain this memorable figure, American Airlines has just reason to be proud. This is, indeed, an achievement that will be long remembered in American aviation.

Proud, too, is the Eclipse Aviation Corporation. For American Airlines' great Douglas Flagship fleet is equipped with Eclipse starting equipment, generators, generator control boxes, booster coils, vacuum instrument pumps as well as other Eclipse accessories.

**ECLIPSE AVIATION CORPORATION**

*(Subsidiary of Bendix Aviation Corporation)*

**EAST ORANGE, NEW JERSEY**




*Published monthly by Aeronautical Digest Publishing Corp., at 515 Madison Ave., New York, N. Y. Yearly Subscriptions, $3. Entered as second class matter July 17, 1922, at the Post Office, New York, N. Y., under the Act of March 3, 1879. Additional entry at the Post Office, Philadelphia.*

# At the Flying Schools . .
# COUNT THE CUBS!



THE NEW SILVER CUB is the profit-making plane! More and more flying schools and fixed base operators are finding the New Silver Cub the simple way to easier, more economical instruction and, consequently, bigger profits. More than 10,000 students are learning to fly in Cubs today! The line-up of Cubs in the above picture taken by Kurt Schelling is but one example of the Cub's tremendous popularity.

There are many reasons for this. First of all is its amazing economy—using less than 3 gallons of gas per hour and almost no oil! And its depreciation and upkeep are the lowest in the industry. Also, it is inherently stable—perfect for training. The New Silver Cub is America's really safe airplane, recovering instantly from a spin when either or both of the controls are released. In addition, it has 4-cylinder dependability, dual controls, ruggedness to stand the abuse of beginners and is as easy to fly as driving a car.

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**47 D Street, Bradford, Pa., U. S. A.**
Cable Address: CUB



*The New Silver*
# CUB
**World's Fastest Selling Airplane**

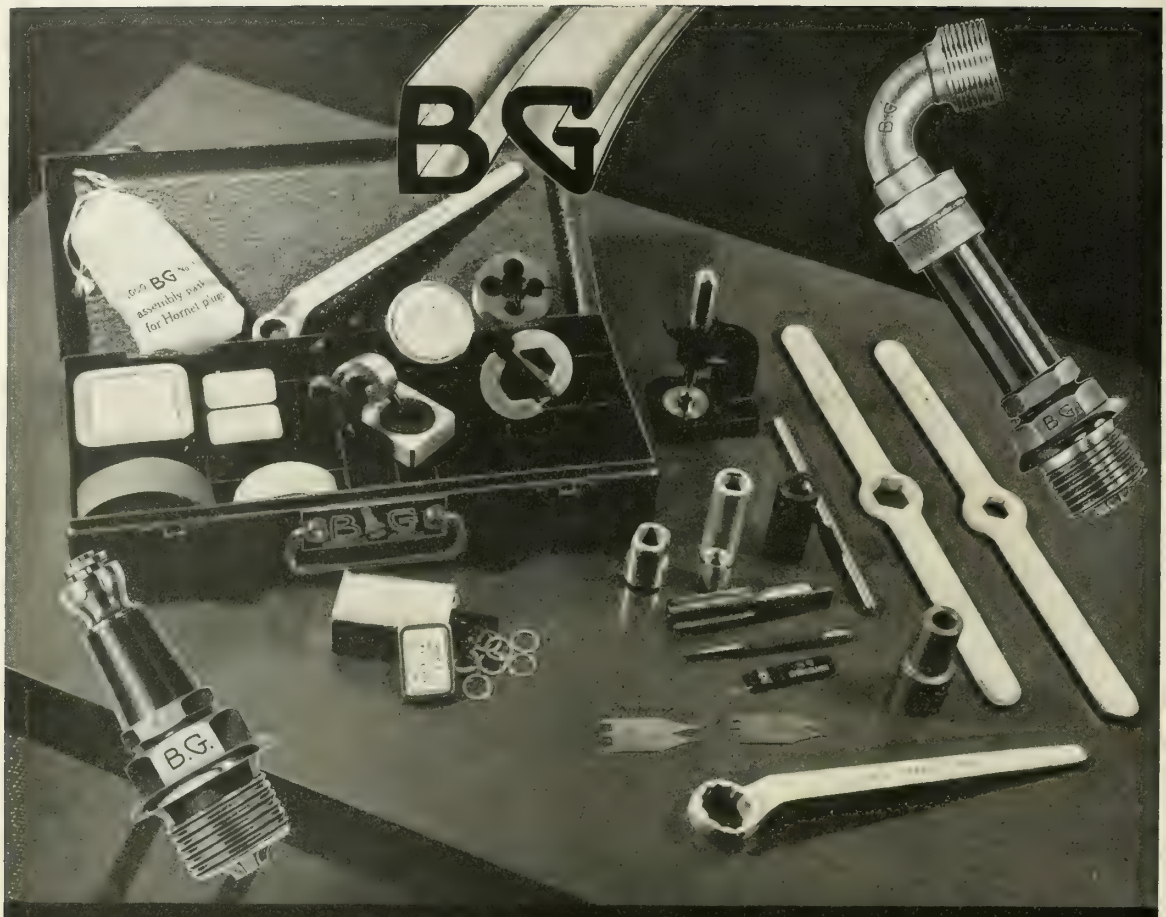
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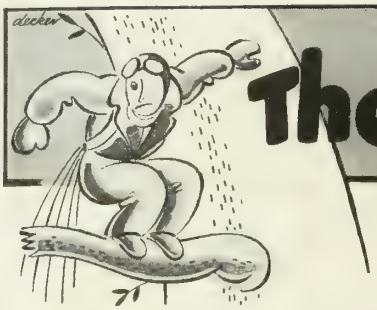
## NEW ELECTRIC TACHOMETER



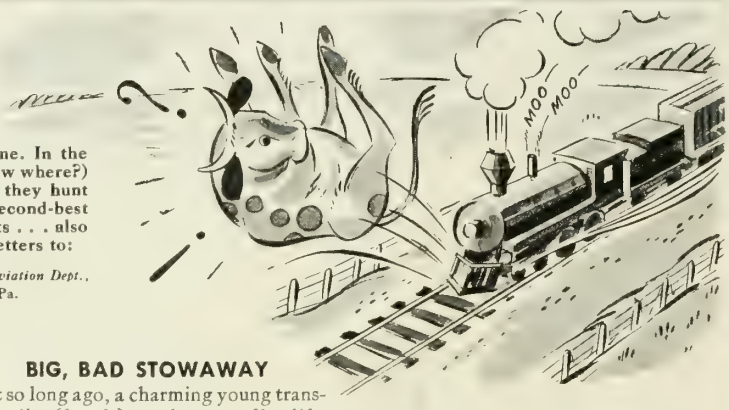

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# The Birdmen's Perch




**Hunting by plane is getting to be a popular pastime. In the West they hunt coyotes . . . some place (do you know where?) they hunt seals . . . and over in the Malay states they hunt eagles and flying foxes by plane. We'd give our second-best goggles to get some first-hand stories of these hunts . . . also any other yarns you have on your chest. Ship all letters to:**

MAJOR AL WILLIAMS, alias "Tattered Wing-Tips," *Mgr., Aviation Dept.*, Gulf Aviation Products, Gulf Building, Pittsburgh, Pa.

## HOW DOES A FLY FLY?



A pilot I nominate for immortalization is "Spike" Callahan. "Spike" washes dishes for a living and, in his spare time, flies. He owns a two-cylinder Cycloplane.

"Spike" attends every meeting of the local pilots association. On occasion, at meetings, he has been known to take a swig from the bottle of white port he carries.

One evening during a lull in the meeting, "Spike", who had been quietly gazing upward, spoke out. "Gents", he drawled, "does a fly half-roll or half-loop when he lands on the ceiling?"

At first, all "Spike" got was a laugh. Then the fellows became interested. By the great slipstream, which way did a fly land?

For weeks pilots chased flies. Arguments raged. Two guys darn near came to blows. Finally our president appointed a bug-committee to solve the question.

Their report, the final authoritative word on the subject, is this: A fly lands on the ceiling at the top of a loop. And to take off again he just falls away head-first in a dive which completes the loop.

Now, ain't that sumpin'?

**—Cecil Meadows, Bakersfield, California**


**A FINE RECORD**



Gulf extends its sincere congratulations to Eastern Air Lines and to Pennsylvania Central Airlines, both recently awarded safety prizes in airline operation by the National Safety Council.

It is a source of pleasure to us that these two companies use Gulf Products in their planes - - Pennsylvania Central using Gulf Aviation Gas, and Eastern using Gulf Aviation Gas and Gulf Airline Oil exclusively.


## BIG, BAD STOWAWAY

Not so long ago, a charming young transport pilot (female) got the scare of her life.

As she was all set to take off, a stowaway peered at her from beneath a seat. She screamed, then scrammed—forgetting, in her fright, to shut off the engine.

The ship crashed. The stowaway was killed. But nobody troubled to attend his funeral, for the poor thing was only a mouse.

**—A. L. G., Nashville, Michigan**

## OF ALL THE NERVE!



A lady called the Meteorological Department at Mitchell Field, saying:

"Will you please give me the ceiling and visibility?"

"Where?"

"Just locally."

"Ceiling 1500 feet."

"What is the dew point?"

"Sixty-five."

"What is the temperature?"

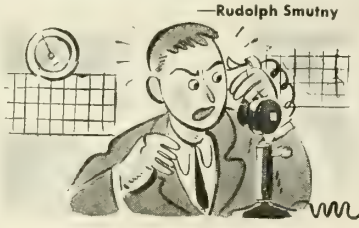
"Seventy."

"Will you please give me the weather forecast for this afternoon?"

"Cloudy. Overcast. No change in temperature. By the way, lady, where are you going to fly?"

"Oh, I'm not going to fly. I just wanted to know whether to serve tea in the dining room or on the terrace."

**—Rudolph Smutny**



## WHOPPER OUT-WHOPPERED

Remember that cow H. R. wrote about in the March "Perch"? The one that drank Gulf Aviation Gas—and gave off milk that was plain dynamite.

I want to warn the bozo (H. R., not the bossy). For we had a cow what did the same thing.

Her milk tasted awful. But being on a railroad construction job, I decided we might get some good out of the stuff. So we put some of it in the boiler of a little switch engine we had.

The switch engine ran swell. Oh, she was the best little switch engine you ever saw. But . . .

When the whistle cord was pulled the engine mooed. When the engine mooed an amorous bull jumped a fence nearby. When the bull met the switch engine he was knocked galley-west.

The bull's owner threatened to sue. We calmed the owner by giving him our cow in exchange, our wonderful cow that gave off high-test gas.

Now the farmer's madder than ever. He bred the cow. The calf was born with no tail but a complete empennage, including vertical fin and adjustable stabilizer. And just as he figured to make his fortune out of the darn calf, the little ingrate flew away and has never been heard of again.

**—Charles L. Funnell, Yonkers, New York**


**Gulf Oil Corporation and Gulf Refining Company . . . makers of**

GULF **GULF AVIATION PRODUCTS**

# *Measure the* **VALUE** *to you of Parks Air College Training*

**IF you measure the value of Parks training by the substantial worth of its curricula, then bear in mind that . . .**

- Four courses are offered, each requiring 8 terms (96 weeks) for completion and each leading to the Bachelor of Science degree.
- All training is on the college and professional school level and the number of hours of training is equal to or greater than is required for graduation from the average 4-year curriculum.
- Each course provides specialized training preparing for entrance to and advancement in one of the major fields of aviation: Professional Flight, Aviation Operations, Aviation Mechanics or Aeronautical Engineering.
- The combining of practical and theoretical training and the high standards of performance required for graduation assure graduates of their ready acceptance by aviation's executives.

**IF you measure the value of Parks training by the demand for Parks graduates, then bear in mind that . . .**

- There is an active demand, in fact, a competitive demand, for all available graduates.
- Seventy-five per cent of graduates go into commercial air transport where qualification requirements are highest.
- Requests for graduates are now exceeding the number available by a wide margin.
- It has become customary to place entire classes prior to the date of graduation.
- Demand is equally urgent for graduates of each of the four major courses.

**If you measure the value of Parks training by the opinions of the industry's most competent authorities, men who are disinterested except that they appreciate having in Parks Air College a source of adequately trained personnel, then consider what they say:**

C. R. Smith, President of American Airlines, Inc., said:
"You are doing a fine job at Parks Air College."

H. D. Ingalls, Superintendent of Maintenance of American Airlines, Inc., said:
"I'm for Parks graduates. They know their stuff."

A. Francis Arcier, Chief Engineer, the Waco Aircraft Company, writing to President Parks, said:
"We would greatly like to fill our vacancy from the ranks of your graduates as we have a lively appreciation of the high standard to which your graduates must measure up."

Carl B. Squier, Vice President of Lockheed Aircraft Corporation said:
"Your graduates leave Parks fully prepared to fill their niche in the industry."

G. W. Vaughan, President of the Wright Aeronautical Corporation, said:
"You have a wonderful institution here."

Donald Frye, Personnel Director of Consolidated Aircraft Corporation, addressing the Parks Aero Club, said:
"We will have a job for any graduate of Parks Air College who comes to us with a letter of introduction from your President."

Jack Frye, President of Transcontinental and Western Air, wrote from Kansas City:
"We appreciate the good work you are doing over there."

Paul E. Richter, Vice President of Transcontinental and Western Air, in Charge of Operations, said:
"You can be sure that when we put on more men we will get in touch with you."

• • • *For complete information about the training that will enable you to win recognition in aviation, send for the Parks catalog. It is free. The filled in coupon will bring your copy.* • • •




AN AIR VIEW OF PARKS AIR COLLEGE, "THE TRAINING DIVISION OF COMMERCIAL AVIATION."
THE ENTIRE SCHOOL PLANT IS USED EXCLUSIVELY FOR AVIATION TRAINING PURPOSES

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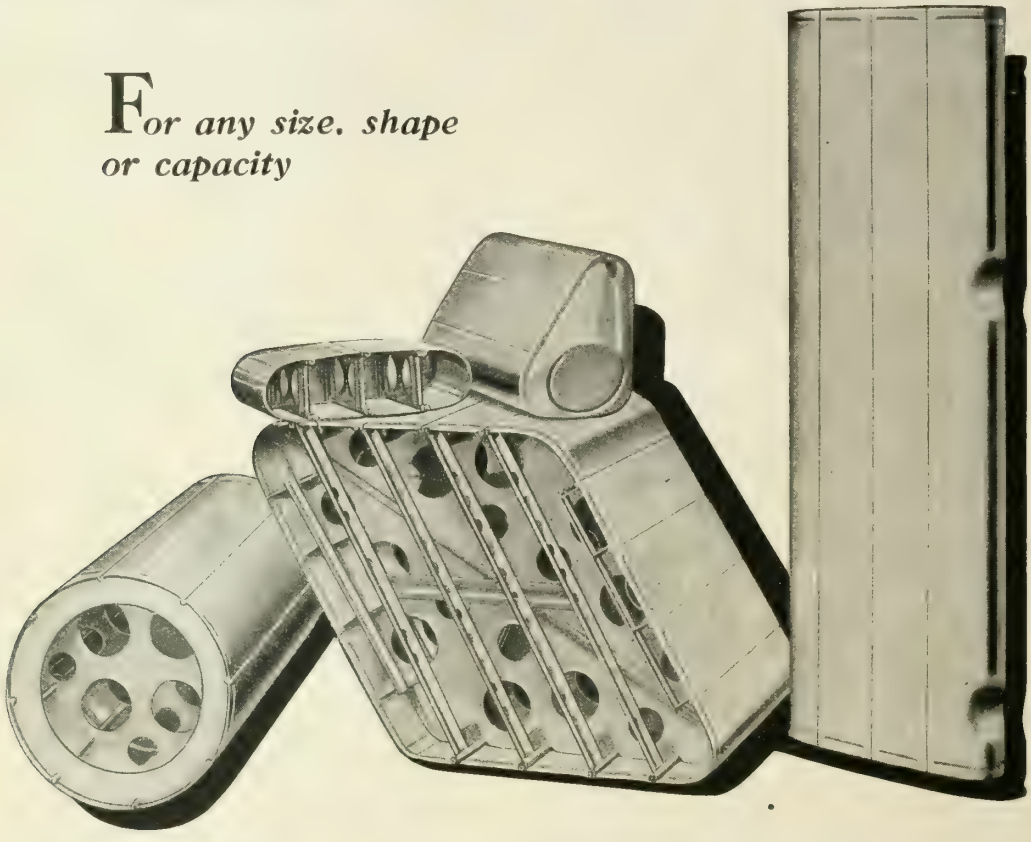
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*For any size, shape or capacity*



**BREEZE** *hook type* **construction assures greater strength and flexibility**

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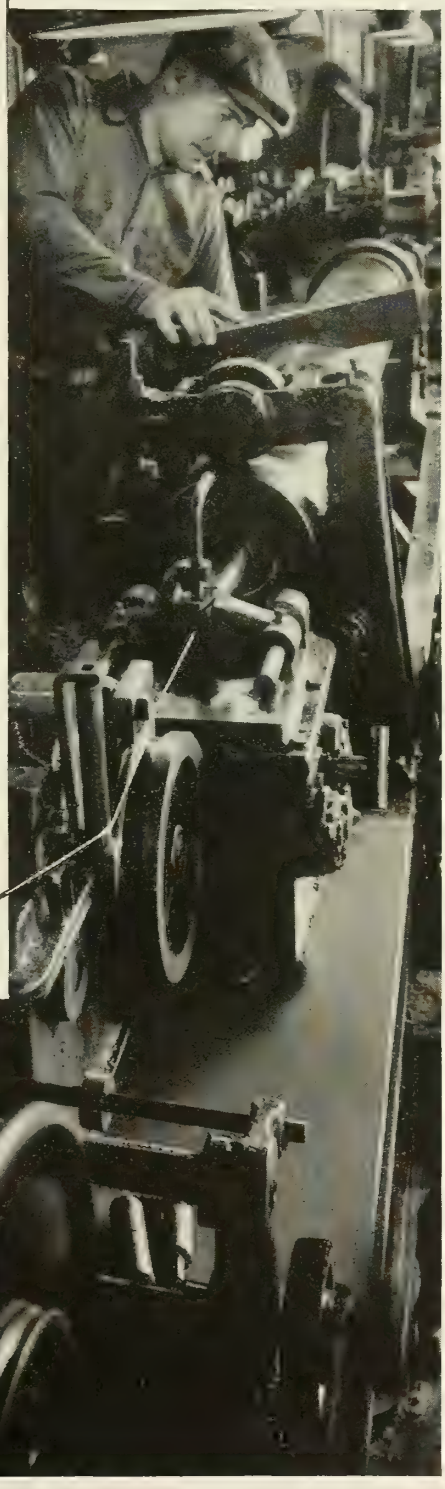
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A. D. May, 1937

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Specially built stranding equipment in the Macwhyte Wire Rope Mill for Hi-Fatigue Aircraft Cable



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C. 290

## MACWHYTE TIE RODS

Streamline ■ Square ● Round

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but we consider it will put our flight students "over the top" and their services will be in demand more than ever before. Dallas students always get the job done.

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that prices of all commodities are on the advance and it will not be long before we will advance the prices of all courses.

### OUR PRICES WILL GO UP JULY 1st.

Get your course reserved and save this big advance for yourself. You can save 25% to 50% at this school over all others and still get MORE FOR YOUR MONEY.

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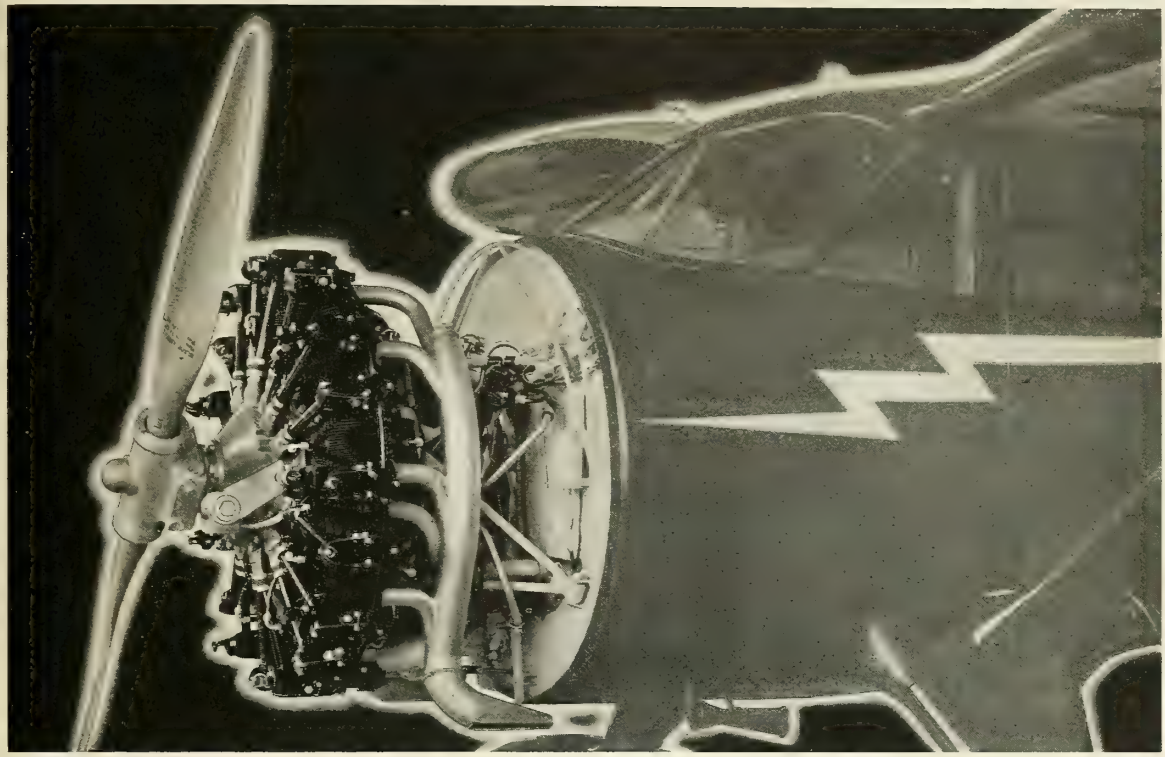
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**SPECIAL ENROLLMENT OFFER**

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THE R-680 Lycoming Engine became famed in the early '30's for reliability and low maintenance costs. Continued improvements through use by Airlines, the U. S. Government, Operators, and Private Flyers has kept this product ahead of its field, outselling other makes in this power class.

The new R-680-D Lycoming Engine is destined to create another HIGH in dependable performance and low operating cost because its design embodies enclosed rocker-arm boxes with pressure lubrication through cam followers and push rods to rocker arm bearings, super-finned cylinder heads cooling BOTH intake and exhaust sides, Nitralloy accessory drive shaft, deep bossed aluminum crank case and other notable improvements found only in the latest pursuit and airline engines.

Stinson has followed the same consistent program of constant improvement without basic, obsoleting changes and now produces, through refinements in design and manufacturing technique, an airplane which is acknowledged to be the most advanced, as regards safe, trouble-free operation, of any airplane in the entire cabin category.

Proof of this is the fact that more knowing and experienced buyers now own 1936-37 models of the Stinson 'Reliant' than all other makes of 4-, 5- or 6-place cabin planes combined and that again Stinson Owners and Flyers have traveled more than 6,000,000 miles in the first quarter of 1937 without an accident which resulted in a fatality to pilot or passenger.

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The 320 HP Wright-powered 'Reliant' also leads. More of this model have been sold to substantial people during 1936-37 than all makes of cabin planes combined in this power class.

The 'Reliant' powered with the Wasp Jr. (450 HP) is now in production and gives "A TRANSPORT RIDE AT AIRLINE SPEED". Orders already booked assure leadership for this outstanding airplane in the higher-powered category.

***All—Built by the Builders of Airline Transports***

Ask any Stinson Distributor and Dealer or write to:

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(DIVISION AVIATION MANUFACTURING CORPORATION)

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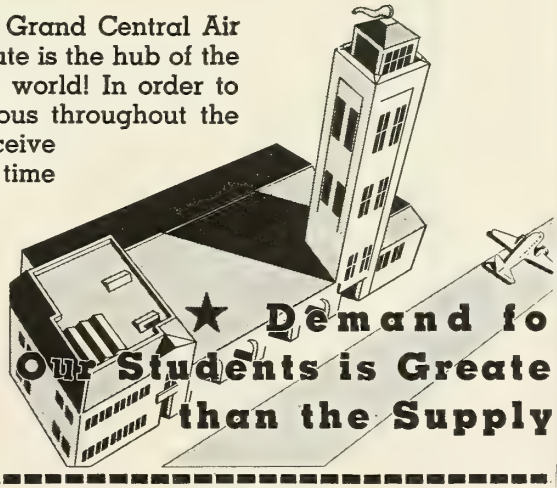
Alis Et Animo

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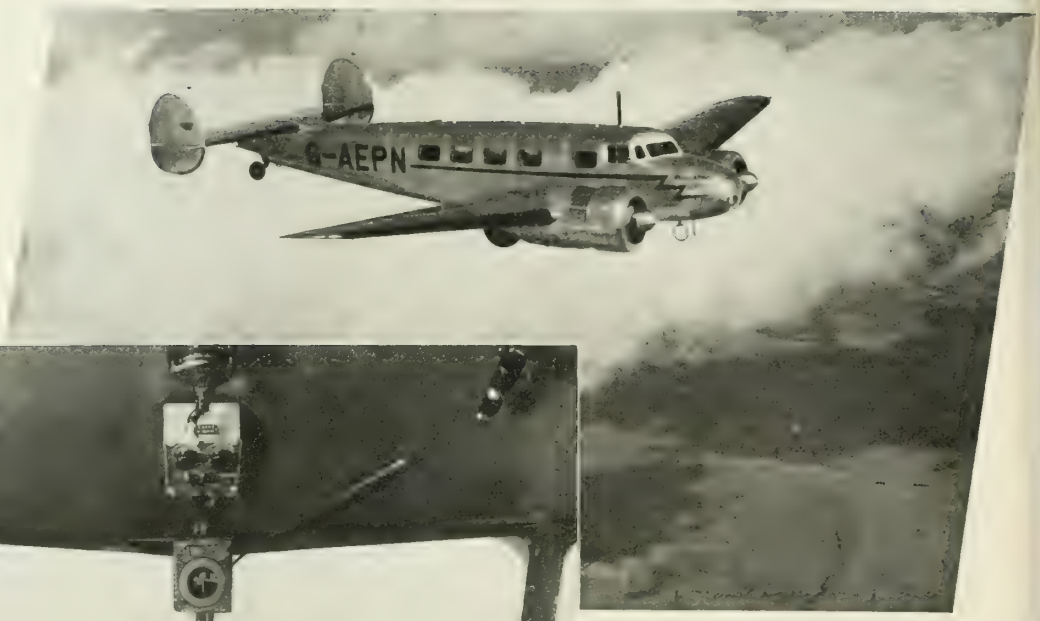
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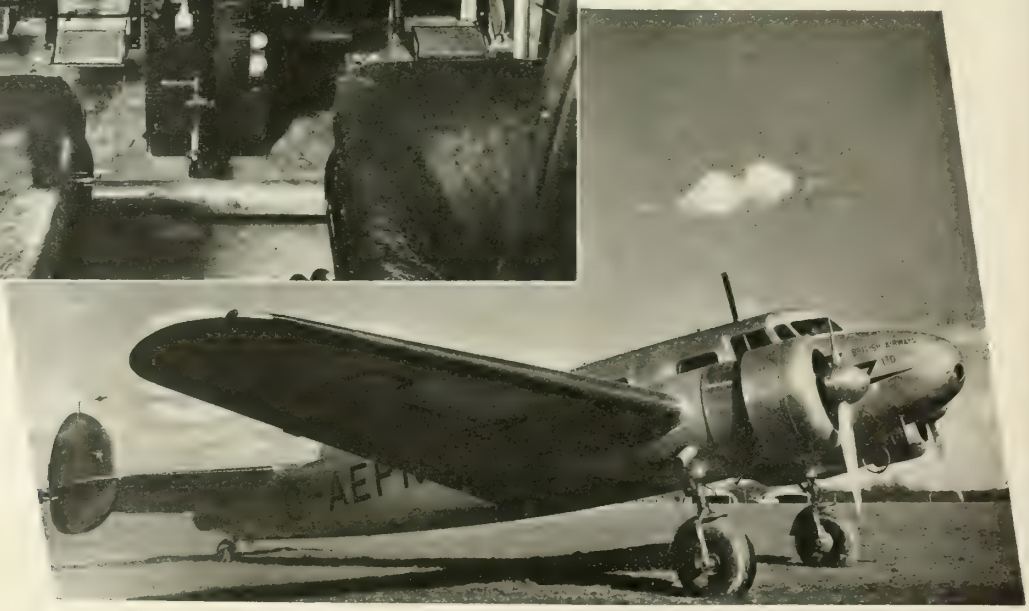


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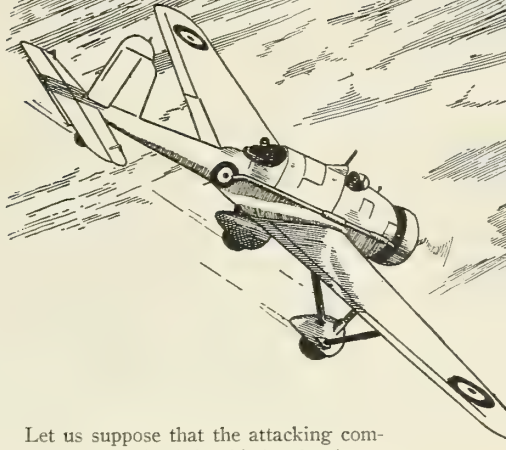





*Beginning of the fleet of five Lockheed "Electra" transport planes British Airways, Ltd., will operate on their Viking Royal Mail Express service to Denmark and Sweden. Three of these 12-place twin-engined ships have been delivered equipped with constant-speed controllable pitch propellers, Goodrich de-icers, radio, and the Lorenz blind approach system. Power is supplied by 450 hp P & W Wasp Junior engines which give a maximum speed of 208 mph and a cruising speed of 192 mph. The view at the left shows arrangement of the pilot's compartment and layout of the instruments which are calibrated in metric system*



# FIRE OVER LONDON



**CY CALDWELL**

● Continuing our effort to educate in air matters our ground based air defenders, General Craig and the General Staff, let us look at the tactical problems involved in the destruction of London, England, by fire, the strategical reasons for which we discussed in April. As an English reader has pointed out, possibly to comfort himself, this problem of air attack with incendiary bombs also may confront New York, Boston, Philadelphia, and other American cities. That is why I have discussed London, for as London is considerably nearer than we are to the front line of international hatred and unrest, London is almost sure to learn by actual experience some time before we do. Furthermore, I would be hard put to it to discuss the defense of any American city, for none of our cities has any air defense today—I cannot accept a few hundred obsolete pea-shooters backed up by mostly obsolete anti-aircraft guns as adequate air defense, though the General Staff evidently considers it ample.

### The Best Defense

London has the best defense against air attack yet evolved—the next war will disclose how effective it is. That the English are thoroughly alarmed is evidenced by the frantically hurried and costly measures they are taking to defend themselves against continental air invasion. During the next five years the British government will spend $7,500,000,000 on war preparedness, most of it for warships, planes, guns, munitions, and war equipment. In five years England will have more than 15,000 first-line fighting planes in all categories—and this is a conservative estimate. When the war starts they will endeavor to step up production to at least 10,000 planes a year.

London will be defended by warships in the Channel—probably light craft mounting anti-aircraft guns. There will be anti-aircraft batteries scattered in quantity from the coast to all around London; and the city itself will be a hotbed of Archie. Spread out from the Channel and the North Sea will be listening posts, afloat and ashore, an air observation net, assisted by air patrols over the sea. Finally there will be balloon aprons over London, and many squadrons of fast interceptor planes based nearby.

Whoever attacks London will not find it a push-over. The English are a fighting people, courageous, industrious, and clever, as they have proved to their satisfaction and profit during the 871 years since the Norman Conquerors set foot on English soil. From their island stronghold they have conquered and now rule a fifth of the world's surface and they will not surrender an inch of it without a terrific struggle. That is in line with English tradition, founded on English nature. What they have they will hold until it is wrested from them by force—something they understand thoroughly having used it profitably themselves for more than eight and a half centuries. Today they are "against war" and in favor of peace, for they have seized all they can handle, want no more, but do not intend to give up any spoils from previous wars.

These are the people and such is the defensive set-up with which an enemy attacking London must contend. In the World War the procedure would have been to ignore the defense and send the bombers over. Today the defense is to be reckoned with. The wise commander will endeavor to neutralize, so far as he may, the power of the defense, not primarily to protect his bombers, but to insure that as many of them as possible shall reach their objectives, drop their bombs, and thus accomplish their missions. An airplane and its crew will be regarded as expendable material, precisely as infantry regiments in 1918 were considered expendable human material. Thus generals and air marshals think and talk in conference behind closed doors. Men and machines are war supplies to be expended coldly to achieve a desired objective. The only military difference between men, bullets, airplanes, and bully beef is their cost and use. That the man can feel pain and fears death does not matter at all.



*In five years England will have more than 15,000 first-line fighting airplanes*

Let us suppose that the attacking commander has decided that his bombardment force of 500 bombers shall arrive over London at midnight. 20 years ago the defenders would have been advised by their listening posts that the enemy was coming; they would be at their batteries of guns and searchlights, calmly sweeping the skies and firing barrages of shells with great complacency and content. Outside of chance bombs hitting near them, or shell fragments dropping back onto their heads, the work was nearly as safe as shooting ducks from ambush and not much more exciting.

We have changed all that today and have found a way of annoying the defense and taking their minds off their work. We have developed the Attack plane. While the bombers are coming in at from 10,000 to 20,000 ft. or higher, the Attack planes are coming along ahead of them, just above the ground, as low as 50 ft. in daylight, as high as 200 ft. at night—in either case just high enough safely to clear all obstructions. The numbers will depend upon various considerations, but in general the proportion of one Attack plane to one bomber should serve to run good night interference.

### Plan for Attack

The Attack should deliver its blows with only time enough to clear off before the bombs start falling—and in this the commander harbors no sentimental weakness for Attack pilots, he merely wants them to return safely so he can use them again and again, until they are used up in other attacks. London will be divided into squares on a map, and each squadron of attack planes will have as its objective batteries of guns and searchlights based in that area. The squadrons will separate into flights and elements to avoid the possibility of colliding with each other, and they will pass over their targets in waves of three or six planes each. Each ship will mount six fixed machine-guns, each gun firing about 1200 shots a minute. The defenders will not even see the planes before the bullets are mowing down everything in front of them but concrete and steel. This wave of Attack planes will drop toxic smoke bombs as it passes over its target. The second wave,

(*Continued on page* 95)

# EDITORIALS

★

**"We have acquired five Lockheed Electra aircraft for the operation of our services to Paris, Amsterdam, Hamburg, Copenhagen, Malmo and Stockholm, and American visitors to this country will now be able to fly in aircraft with which they are already familiar. The introduction of these aircraft on our services has aroused world-wide interest and has enabled us to accelerate all our capital-to-capital schedules, bringing Paris within 85 minutes flying time of London. Passengers on our Viking Royal Mail Express service to Scandinavia can now have breakfast in England, tea in Denmark, and dinner in Sweden, thus bringing the Scandinavian countries within hours instead of days of London." *The Hon. Clive Pearson, Chairman of Board, British Airways.***

## Recognition of Airline Safety

Recent mishaps on airlines have caused the layman to question airline safety, but this feeling was not shared generally, for traffic reports show that for the first two months of the year, month for month, more people are flying in 1937 than last year.

It is therefore gratifying to witness the public recognition of safety in air transportation, for the first time, by such a group as the National Safety Council. While tangible recognition of a good job, safely accomplished, was given to Eastern Air Lines, Northwest Airways, and Pennsylvania-Central Airlines, it was timely acknowledgment of the efforts being made by the entire air transport industry in making air travel in this country a safe and dependable medium of travel.

## Ground Facilities For Transports

Safety standards being written into Air Commerce Regulations governing operation of the new four-engined transports call for a reclassification of the country's airports to be designated as super terminals, terminals, and limited terminals, replacing the present system.

Proposed regulations for the super terminal call for runways in four directions, each at least 4000 feet in length and diverging from one another by angles of at least 80 degrees. Zones of approach at the ends of these runways must permit pilots to land and take-off at the prescribed angle of not less than twenty to one.

This means that only 30 of about 190 airports serving scheduled air transportation lines qualify in the highest of the three classifications. The others will have to be expanded in order to comply with the requirements or else become relegated to a lesser classification, thus either losing their dominating places in the air transport map, or accepting service by "local" or feeder line planes.

During the past ten years most of our principal airports have been outgrown and outmoded by the modern airliner. It is obvious that a greater degree of technical skill is being employed in the building of the new transports than in evolving adequate places from which to take them off and set them down.

Many of the present airports have reached the limits of their boundaries —they cannot expand because adjoining land is not available. Such sites could well be utilized for student and private operations, a new and larger field, meeting the present requirements, being built for the exclusive use of air transport operations. Of course such sites must be chosen with a careful appreciation of possible future demands. The exclusively transport terminal must come, for even now airways in the vicinity of airports are becoming crowded.

The commendable action of the Bureau should furnish the impetus which will result in providing this country with airports comparable in every way to the transport planes they are expected to accommodate.

## Postpone the Trans-Atlantic Race

As we pointed out last October, many aeronautical groups in the United States doubt the practicability of the proposed trans-Atlantic race, the idea of which originated in France, to "commemorate the tenth anniversary of Lindbergh's New York-Paris flight."

We approach the time when regularly scheduled air transport across the North Atlantic will become a reality and since such a race will be attended by known hazards that may result in disaster for contestants, progress in scheduled air transport by airplane will be retarded if the race is carried out unsuccessfully.

Tremendous strides have been made since Lindbergh made his flight, and in the near future even greater advancements in air navigation aids and in the construction of suitable aircraft and engines will be effected. If the sponsors insist that the race be held, a later date would offer less chance of failure like the ill-fated Dole race over the Pacific ten years ago.

Let no plans for a spectacular air race interfere with the natural and orderly progress now being made to establish passenger air lines across the Atlantic. We have too much at stake to risk failure at this time.

## Retirement of Racing Pilots

Development of new racing craft which embody advancements in aerodynamic design is the backbone of aeronautics. As a result of this work commercial and military aircraft, and their engines, have been able to make such remarkable service records.

Unfortunately the number of racing pilots with engineering ingenuity is small. The fact that racing is seldom financially profitable has much to do with this condition—pilots are prone to concentrate their efforts on aeronautical work more immediately remunerative.

It is to the racing pilots of yesteryear to whom we may look for further engineering advancement, for as they leave the high-speed racing to younger men, they may devote their time and experiences to equally important but less spectacular phases of experimental flying and flight research.

These men can do more for the industry they love by applying knowledge gained by racing, where it will be useful in new developments. There are plenty of piloting and other problems still to be solved, and our former speed pilots will continue to find them worthy of their time and attention.

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TEXACO

# *Aviation Products*

# JAPANESE AVIATION

PEYTON M. MAGRUDER



*A line-up of Japanese training plan*

● The history of modern Japanese aviation seems to have been launched some 125 years ago with the flight of a crude kite-glider which promptly crashed. The unfortunate Samurai, who had dared the displeasure of the gods, in his untimely effort to overcome the force of gravitation, was promptly hailed before the local feudal Lord and executed for his "unnatural and devilish" act. News of this event evidently passed from father to son with typical Japanese thoroughness, because during the following century we find little evidence of other pioneers attempting to emulate such exploits.

In 1892, Charles Spencer, an American, introduced a balloon in Japan which aroused tremendous interest in military circles. However, nothing further of aeronautical interest seems to have occurred until 1909 and 1910 when another American demonstrated a small airship over Tokyo. The effect of this was that Naval Commissions were promptly sent to France and America to study aviation.

In 1910, Lieut. Tokugawa returned from France with a Farman equipped with a 50 hp Gnôme-Rhône engine, which he flew and exhibited. The same year, Capt. K. Hino, an Army officer, brought from Germany a Hans Grade monoplane which he flew at Tokyo.

A Wright biplane and a Bleriot monoplane were next imported and used for training flights and for experimental work. The results of these preliminary flights were so encouraging that Tokugawa, now promoted to Captain, built and flew the first Japanese-built military airplane powered by a Gnôme-Rhône of some 50 hp.

Tokugawa was the "father" of the Japanese Army Flying Corps, and it was primarily through his efforts that the latest foreign models were continuously introduced into Japan for training, experimentation, and later for reproduction by Japanese engineers with local materials. For his services to Japanese aviation, he was created a Baron and promoted to Lieut. General.

### Naval Aviation

While the Army was struggling with Farmans and Nieuports, the Navy was learning to fly in two Curtiss seaplanes imported in 1912 by Kiyoichi Nakajima (now president of one of Japan's largest aircraft factories) who had been a member of the Naval Commission sent to the U. S. in 1910. Soon a number of seaplanes were introduced and extensive open water flights undertaken from the *Wakamiya*, a transport ship which had been reconstructed to serve as a seaplane carrier.

Attempts were constantly made to duplicate the various foreign types, but few of these efforts were successful—the majority ending in crashes or as one Japanese writer put it, "To the regret of the parties concerned, the flight ended with a loss of four crew, the boat clashing with the ground."

The year 1914 saw the first flying boat introduced in Japan by I. Unno who had returned with it from the U. S. Test flights were made at Naruo, near Osaka, but before a scheduled public appearance could be made "the boat had unfortunately been burnt down with severe engine troubles".

The first moderately successful public demonstration of a flying boat was not made until 1918 when a Tellier type was imported from France. The boat, a two-place biplane with a 200 hp Hispano-Suiza engine, was also soon destroyed.

In 1921, the Japanese government invited a British Aviation Commission, headed by the present Lord Sempill, to reorganize, equip, and train the Imperial Japanese Naval Air Service. Numbering 30 officers and enlisted men of the Royal Naval Air Force, this commission spent three years in Japan during which time efficient and progressive methods were substituted for the haphazard systems of training of personnel, of construction, and of organization which had previously been in force. A variety of the latest types of British military planes were purchased and large scale operations begun to form the basis for a sizeable naval air force which was then planned by the Japanese Admiralty.

The Japanese Navy was the first navy to build an aircraft carrier, the keel of the *Hosho* being laid in December, 1920,





*Above: the Mitsbubishi "Obtori" all-metal bomber. Left: Army observation type, the Kawasaki 88*



*horsepowered two-place Army types*

*This concludes the series of articles on foreign military aircraft which has appeared in AERO DIGEST since May 1936. British, French, Italian, German, Russian, and now Japanese, military (and in some cases, commercial) aircraft have been presented in a digest of types, constructional features and performances. Mr. Magruder is an Annapolis man and graduate engineer, (now Aeronautical Engineer, Naval Aircraft Factory); as a student of aviation he has spent considerable time in the Orient, Africa, Europe and the Americas. All articles in this series represent the author's personal views and represent no official opinions or information of the Navy Department or the Bureau of Aeronautics.*

at the Asano shipyard. Flying deck operations, however, were not begun until 1923 when the first flights were made under British instruction.

In the meantime the Army Air Force had been reorganized and trained under the direction of a similar commission of French officers, led by Lt. Col. Faure, who had come to Japan in 1919. The Spad and Nieuport had both been adopted as standard and were being produced in large numbers, under license, at the Nakajima factory.

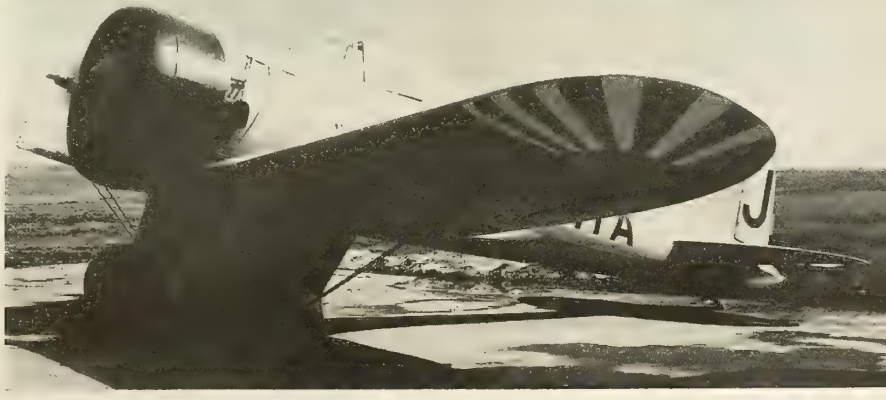
Production by the Navy of the F-5 Short Brothers flying boat, a 4-place biplane equipped with two Rolls Royce *Eagle* engines of 350 hp, and of the F-1, a modification with 400 hp Lorraine engines, was undertaken under the direction of British instructors. Flights extending over 4000 miles were made between Yokosuka and Saseho in these flying boats which were made entirely with Japanese materials. In 1922, a number of amphibions, the Supermarine *Seal* and Vickers *Viking* types were imported from England and the Schreck F.B.A. 17 (180 hp Hispano engine) from France. At the same time, a Curtiss *Seagull* was brought from the U. S., and after a short demonstration was copied and built by the Itoh Aircraft Co., (now defunct) and later (in a modified form) by the Kure naval aircraft factory.

A Savoia Type 13 flying boat was purchased in 1924 but was destroyed in its first test flight. Following this loss, ten Rohrbach II (two 360 hp Rolls Royce engines) all-metal flying boats were imported and produced with 450 hp Hispano and Lorraine engines. A Supermarine *Southampton* was next purchased for experimental work, but the R-2 Rohrbach type (constructed with Japanese materials) proved superior, so the earlier models were continued in production.

Dr. Ing. Dornier visited Japan in 1927 and introduced the *Wal,* the *Delphine,* and the *Libell* types of all-metal flying boats. These proved to be popular and construction was begun at the Kawasaki Dockyard Co. which had already built large numbers of French Salmson biplanes and engines, under license, for the Japanese Army. Dornier remained in Japan long enough to supervise the construction of several flying boats and his influence is still apparent in the boats produced since 1927.

Other types of naval planes had been produced under the design of Mr. Folland of the Gloster Co. of England by the Mitsubishi concern, one of the pioneer industrial establishments in the Far East. A Sopwith biplane (300 hp Hispano engine) was named the Navy 10 type fighter and was produced in large quantities. This was the standard fighter of the services until 1928, when the Gloster *Gambet* was adopted after a world-wide design competition.





*Above: the long-range Mitsubishi 93 bomber. Right: single-seater Nakajima AN-1 fighter for the Army*

### Present Strength

The total first line strength of the Imperial Army and Navy Air Services is, approximately, 1700-1800 planes almost equally divided between the two forces. Of the Navy's 900 airplanes, about 600 are shore based, only 300 being carried with the Fleet. The estimated relative portions of the various types of planes in active service are:

| Army | | Navy | |
|---|---|---|---|
| Fighters | 40% | Fighters | 35% |
| Bombers | 30% | Bombers | 20% |
| Observation | 15% | Observation | 25% |
| Miscellaneous | 15% | Miscellaneous | 20% |

The so-called first line strength is misleading, as less than 20% are modern aircraft. The remainder are from 2 to 7 years old, performance being that usually associated with military aircraft of the period from 1930 to 1932 in the U. S. and Europe. The present day Japanese air force, however, is almost entirely of Japanese construction and materials. Design has not followed construction in that nearly all Japanese military planes are direct copies of types produced elsewhere or are built under license using the original design of a foreign model. Japanese designs, while ingenious to the extreme in certain ways, seem to lack the fundamental quality of originality.

It must be realized that technical progress in Japan is made only by overcoming tremendous handicaps which do not hin-



*Administration building at the Tokyo International Airport*

der Occidental engineers. In the U. S. and Europe we have the advantage of prompt interchange of ideas and innovations through numerous technical laboratories, schools, and government-subsidized institutions. In Japan, the scientist is retarded by a language not only difficult to learn, but nearly impossible to translate. The written and spoken languages are different. Research workers in Japan must also become proficient in at least two or three languages before they can begin to work if they hope to benefit from progress made in other countries.

Aeronautical research in Japan is carried out mainly at the Imperial University in Tokyo under the direction of a group similar to our NACA. The Aeronautical Institute founded in 1916 and rebuilt after being destroyed by the earthquake of 1919, carries on research in 12 sections: Physics, Chemistry, Metallurgy, Materials, Aerodynamics, Engines, Aircraft, Instruments, Psychology, etc. Additional research for the air services is carried out at the Naval Air Service Laboratory, Tokyo, and at a similar organization for the Army at Tokorazawa. The University at Sendai also undertakes advanced studies and research as does the Central Naval Air Training Station. The latter, however, specializes in full-scale test work. There is also a large tank for seaplane experimental work at the Mitsubishi Co. and a completely equipped naval factory for producing experimental types.

#### Aircraft and Engine Manufacturers

There are at present eight private aircraft manufacturing companies in Japan: Aiba, Aichi, Ishikawajima, Kawanisi, Kawasaki, Mitsubishi, Nakajima, and Gasu Denki. The Aiba Co. builds small cabin biplanes for commercial use only and operates an air service between Tokyo and Simuzo. Aichi builds seaplanes and flying boats for the Naval Air Service in addition to an engine of its own design and the 400-450 hp Lorraine engines under license. Ishikawajima specializes, at present, in the production of training planes. Kawanisi builds seaplanes, parts, and accessories for the Navy. Kawasaki, in addition to German BMW engines built under license, produces a number of heavy bomber types for the Army. The Mitsubishi Co. (founded in 1855 as a ship building concern) produces a variety of military types, Hispano, Armstrong Siddeley, and Junkers engines, as well as numerous accessories, under license. Nakajima builds military as well as commercial types and holds licenses to manufacture both Lorraine and Bristol engines, and the Douglas DC-2. The Gasu Denki concern of Tokyo builds a series of radial air-cooled engines of its own design and produces an excellent copy of the de Haviland *Fox-Moth* biplane (1933 type).

#### Present Types of Military and Naval Aircraft

The Nakajima AN-1, a recent modification of the older Army 91 type, is the only modern high-speed single-seat fighter in the Army. It has a top speed of 245 mph equipped with a 550 hp Nakajima radial engine. Weight fully loaded is 3300 lbs. and climb to 9840 ft. requires 3.5 min. Its resemblance to the U. S. Army's Boeing fighter is apparent.

Another army fighter is the type 92 built by Kawasaki. With a Kawasaki BMW engine of 500 hp, top speed is 205 mph, gross weight 3800 lbs., and climb to 17,000 ft. requires 9 min. The single-seat 92 type fighter, built entirely of Japanese woods and aluminum alloys, is now about five years old and practically obsolete.

The Naval Air Service is principally equipped with the type 90 Nakajima single-seat biplane fighter powered by a 450 hp Jupiter engine built under license. Constructed of welded steel type (fuselage) and light Japanese woods (wings), it has a top speed of 193 mph and weighs 2900 lbs. fully loaded.

A more recent single-seat biplane fighter, the type 95, has gone into quantity production for the Navy. Fuselage is of steel tubing and wings of wooden spar and rib construction, fabric-covered. Equipped with a Kotobuki 500 hp radial air-cooled engine, top speed is estimated to be 205 mph.

The Army operates three standard observation types, the Mitsubishi 92 monoplane, the Kawasaki 93 light bomber-reconnaissance, and the Kawasaki 88. The first, a two-place, braced high wing monoplane is powered by a 420 hp *Jaguar* (Armstrong Siddeley licensed) air-cooled radial engine, and with a useful load of 1540 lbs., has a maximum speed of 138 mph, a range of 420 miles, and a service ceiling of 20,000 ft.

The type 93 is a two-place, all-metal biplane equipped with a 600-700 hp Kawasaki BMW engine. Carrying full military load, gross weight is 5200 lbs., range 400 miles, and maximum speed 162 mph. Large numbers of this type have been supplied to the army within four years.





*Above: Navy 91 Flying Boat which recently made a 2300-mile non-stop flight. Right: Army 93 day bomber, powered by a 700 hp engine*

Now obsolete, but still in service in many army squadrons, is the 88 type biplane, also made by Kawasaki. This model has a top speed of 143 mph and weighs 6300 lbs. fully loaded. A Kawasaki BMW engine of 450 hp or 500 hp are alternate power plants.

#### Navy Observation Planes

The Navy is equipped with a number of variations of several main types of reconnaissance or observation seaplanes. The Kawanisi 90, a two- or three-place biplane, has a maximum speed of 162 mph powered by a 450 hp Jupiter engine. Gross weight is 5500 lbs. for the three-place type, which has lines similar to the Vought *Corsair*.

The Kawanisi 94 is a three-place, twin-float seaplane equipped with a 500 hp 12-cylinder Navy type 90 water-cooled engine. The fuselage is of steel tube framework covered aft with fabric. Top speed is 167 mph with a gross weight of 5320 lbs. and range is estimated to be 525 miles at cruising speed.

An obsolete type, the Ishikawajima T-36, over seven years old, is still in service to a limited extent. This model is equipped with a 450 hp Kawasaki BMW engine and has a maximum speed of 137 miles an hour.

There are three standard bomber types now employed by the Army: the Kawasaki 88-II, the Kawasaki 93, and the most recent, the Mitsubishi *Ohtori*.

The 88-II, a biplane of wood and fabric construction, has a top speed of 130 mpn with a 450 hp BMW engine. Gross weight is 6820 lbs.

The 93, a low wing monoplane, is similar to a recent Junkers design. Fitted with BMW engines of 500 hp and with a gross weight of 17,800 lbs., maximum speed is 140 mph, ceiling 16,500 ft., and range 650 miles.

The *Ohtori* is an all-metal, low-wing, cantilever monoplane. Equipped with two 700 hp radial Kotobuki engines built under French license, top speed is 240 mph. This is one of the few real modern types in active use in the Japanese army. Of clean design, it features a number of outstanding improvements over earlier models, such as retractable landing gear, twin fins and rudders, semi-monocoque construction and metal propellers. It is said to have completed a non-stop flight between Tokyo and Bangkok, Siam, a distance of more than 2000 miles.

The Navy's bombers are modifications of the Navy 94 observation and Army 92 biplane types, previously described. There are several flying boats now in active service—the 91, a high-wing monoplane equipped with two 600 hp in-line water-cooled engines, and the 90-2, a monoplane modeled after an earlier Short Bros. prototype, equipped with three 800 hp Rolls Royce *Buzzard* engines. The 91, carrying a crew of five, recently completed a non-stop flight of 2300 miles. Top speed is 139 mph. The 90-2, weighing 28,600 lbs. fully loaded, has a maximum speed of 137 mph and a range of 1600 miles with a crew of six and military equipment.

#### Reconnaissance Flying Boat

Another all-metal flying boat is the Aichi AB-4 biplane, a three-place reconnaissance type. It utilizes Handley-Page slots on the upper wing and servo rudder controls. The 300 hp in-line inverted water-cooled Gasu-Denki engine is mounted between the wings and drives a pusher propeller. Maximum speed is 110 mph, ceiling 8000 ft., and range 600 miles with a gross weight of 5280 lbs.

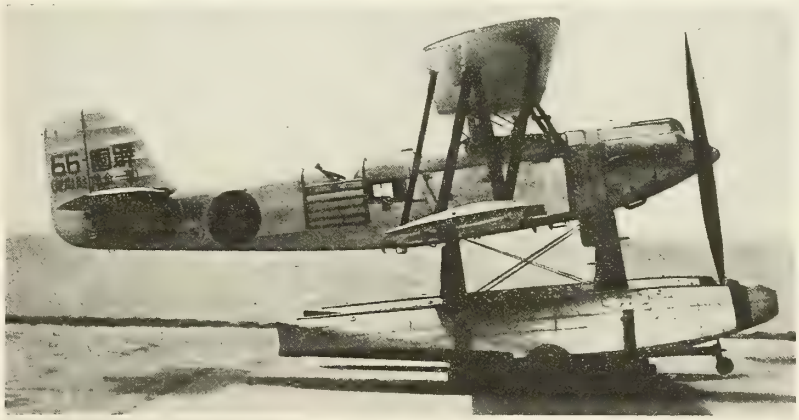
A number of experimental types are now in production. These include a single-seat fighter for the Navy designed after the British Hawker *Nimrod*, a heavy bomber resembling the Martin B-10, and several observation planes based on recent Curtiss and Vought models employed by the U. S. Navy.

Several Douglas DC-2s built under license by the Nakajima Co. are used on inland and Formosa air lines.

Considering the fact that within the space of 60 years Japan has developed from a community, organized from an economic standpoint on medieval lines, to a major industrial power, the development of the Japanese Air Forces seems nothing less than remarkable. Superficially, type for type, and numerically, Japan is perhaps three years behind the rest of the world in air power, but in the growth and development of industries which are necessary for the proper future of her aviation Japan is first. The 9800-mile flight last month from Tokyo to Paris by Masaaki Iinuma and his radio operator Kenji Tsukagoshi, however, shows how Japan has progressed in aeronautics. Flying a Japanese built low-wing, all-metal Mitsubishi monoplane powered by a 550 hp Nakajima engine, the pilots set a new record between the cities by negotiating the distance in 94 hrs. 18 min. at an average speed of about 198 mph.



*Interior of the passengers' waiting room at the Toyko (Haneda) Port*





*Above: Kawanisi three-place reconnaissance plane for the Navy. Left: the two-place T-36 built by Ishikawajima for Japanese Army training use*

# SOME METHODS USED IN THE STATIC TESTING OF AIRCRAFT STRUCTURES

***EDWIN W. WALKER***
Brewster Aeronautical Corporation

**The previous article in the November 1936 issue of AERO DIGEST covered static testing of tail surfaces and touched on testing of wing ribs. The static testing of wing ribs will be explained in more detail in this article and methods used in the static testing of ailerons, wing flaps and tabs and control systems will be dealt with. Although digressing from the title of this article the methods used in the dynamic testing of tail wheels and landing gears will be described.**

● Contemporary monoplane wing construction of the box beam type usually consists of front and rear webs and top and bottom flange plates assembled by various aluminum alloy extrusions and shapes. This type of construction makes it necessary to attach the leading and trailing edge ribs to the flanges of the box beam by clips or reinforcements.

In this case the box beam supports the leading edge or nose ribs and the trailing edge ribs. Test specimens of nose ribs and tail ribs must be attached to sections of the box beam of great enough span to simulate the actual beam on the airplane unless the ribs are located at a station on the beam which has a bulkhead. Here a 2" spanwise beam is sufficient. Although each rib on a tapered wing varies in length and depth, one rib which has the greatest spacing along the span is all that is necessary to test, unless, due to cut-outs for landing gears or equipment installation, special ribs have to be built and tested.

Test loads are obtained from the stress analysis of the wing, from which the critical flight condition is determined. For example, an angle of attack of $\alpha = 28°$ or $\alpha = -3°$ may be the critical conditions for an up and down load respectively on the nose rib, whereas a trailing edge rib loading may be critical for the landing flap down or for the diving flaps open. The actual chord-wise loading of the rib is as shown in figure 1.

Correction must be made for the spanwise distribution of loading as shown in figure 2. This spanwise distribution curve is determined from NACA reports dealing with the pressure distribution over tapered wings.

Actual load distribution to top and bottom surface is then determined from NACA pressure distribution tests, and a loading schedule is compiled to accommodate the number of concentrated loads. These loads are not actually concentrated, as they usually are distributed over 1.5" or 2" by wooden blocks to simulate actual air loading conditions. The spacing of these loads may vary from 2" to 4" along the chord. Two or three lateral supports, usually placed between the concentrated loads, consist of hard wood blocks on each side of the rib, but if the leading edge skin is attached to the rib, these are unnecessary.

Procedure for applying the test loads is as follows: If a rib testing jig of the customary lever type is used, the loads are built up to 40% or 50% of the ultimate design load by running the loads out on the lever arms. This is done to take out any slack in the rib set-up. It is usually sufficient to take deflection measurements at the leading edge, center of the beam and trailing edge. The rib is set on zero reading while the rib is under a small initial load of 10% or 20% of the ultimate design load. The load is then run up in increments of 10%, taking deflection readings and returning to the initial load after each load application to determine if there has been a permanent set of approximately 1/32". Loads are built up until the rib fails. Care is taken to relieve the loads at the end of the arm before the rib is completely destroyed so that the exact point of failure may be noted.

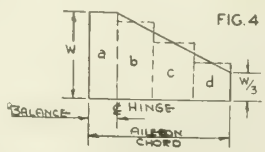
From curves plotted from data noted in a number of tests of truss-type and shear web-type ribs, the factor of 1.35 for the relation between yield point and ultimate load has been checked for the shear web type. It was found that for the truss type of construction that the factor should be nearer 1.15. No definite conclusion can be arrived at for a factor on the latter, because it was found that the factor was affected by the type of failure. The results of a nose rib and trailing edge rib static test are shown in figure 3 in which curve 1 = nose rib, condition — up load $\alpha = +28.50°$; curve 2 trailing edge rib, condition — flap down 30°. Deflections (in inches) were measured at the leading edge and at the centerline of the flap hinge.

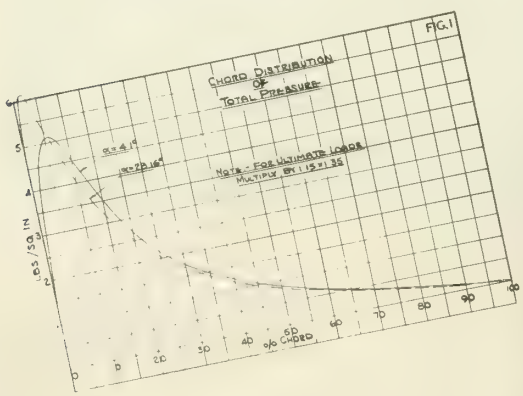
Ailerons are usually tested without their covering but with the diagonal tab bracing sewed in place to give some lateral support for the aileron ribs. Shear wrinkles, lateral buckling or other types of failure within the aileron can be closely observed as the test progresses.

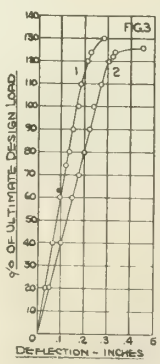
The ultimate design load for the aileron is 60 lbs./ft.² and the distribution is shown

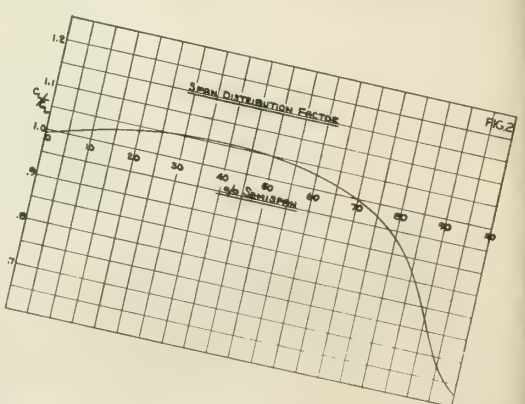
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FIG. 4





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(*Continued from preceding page*)
in figure 4. For convenience the total load is broken up into the four loads: a, b, c and d which are applied by bags of lead shot or sand to these areas which are marked out on a piece of plywood 3/32" thick cut to the contour of the aileron.

Actual test set-up for the aileron is best done by bolting the aileron support brackets directly to the web of a 15" or 20" deep steel channel. However, any base may be used for these fittings providing it is rigid enough to prevent deflections contributing to aileron deflection. Deflection readings are taken by tabs of 1" wide aluminum alloy strips to which is attached 20-to-the-inch cross-section paper. These tabs are attached at 3 or 4 points along the trailing edge. A fine wire stretched between two supports serves as a convenient reference line to which the readings are read. The results of the aileron test are plotted in figure 5.

The aileron tab is tested in a manner similar to the elevator and rudder tab. The tab is hooked up with as much of the control system as necessary and a load applied to the tab by sand bags. The chord distribution on tabs will be difficult to obtain but as the actual load applied will be practically rectangular, the results will be on the conservative side.

Tests on wing flaps were made on a jig consisting of the flap support brackets bolted directly to a 3.5 × 15 steel channel. The set-up is made similar to that for ailerons and test procedure is the same.

The elevator control system is proof-loaded on the actual airplane by attaching a Chattillon spring scale to the control stick grip and the load is applied by a person sitting in the pilot's or observer's seat. The scale may also be hooked up so that the aileron and rudder control system may be proof-loaded without an elaborate test set-up. For these tests the control surfaces must be well-braced by felt padded supports to distribute the loads. If the control surfaces are not installed, or if the load on the control stick or on the rudder pedal results in larger loads on the control members than the control surface loading would place on these members, the control surface horns must be clamped or bolted to a rigid support. The requirements are a proof load of 200 lbs. fore-and-aft on the control stick grip for the elevator controls and 100 lbs. side load on the control stick grip for the aileron controls. The required loading for the rudder controls is a 200-lb. push on the rudder pedal.

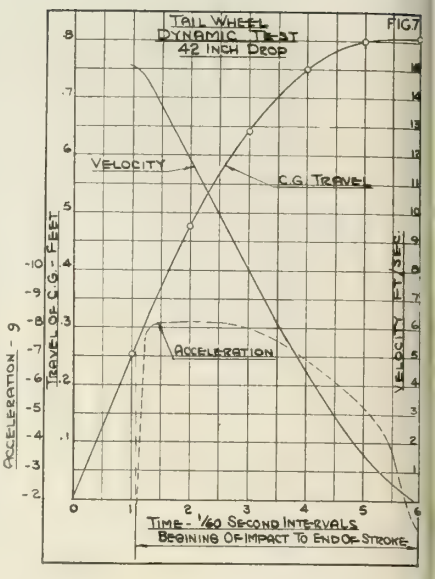
If the cockpit is too small to apply the control stick loads as described, an alternate method consists of a loading platform for sand bags attached to a cable extending through the bottom of the fuselage and over a pulley to give the load in the correct direction.

Methods for dynamic testing of landing gears and tail wheels will next be described. The landing gear may be tested by using either the complete fuselage as built for the actual airplane or by building a drop test jig using a framework of angle iron or of wooden beams incorporating enough of the fittings and fuselage members to adequately distribute the loads. Obviously, the least expensive method of drop testing is to drop the completed airplane. However, it is difficult to provide a stop which would prevent the destruction of important structural members in the fuselage and wing if the landing gear should fail.

Figure 6 shows a method which has been used for drop testing a tail wheel. The fuselage is replaced by a built-up wood beam. The tail wheel struts and fittings were attached to a short section of monocoque fuselage.

Sand bags were located on the fuselage to simulate the actual gross weight condition of the airplane. The acceleration developed in each drop is recorded on a space time recorder. The "space record" or the travel of the center of gravity of the falling drop test jig through space is recorded on a paper tape. Time measurements are recorded by a pencil point at a 1" radius attached to the shaft of a constant-speed electric motor. After a drop is made, the series of penciled loops on the length of paper tape are interpreted by measuring the distance in inches between adjacent loops. Since the time required for each loop of the constant speed motor is known, a curve is then plotted for the travel of the cg versus the intervals of time from the beginning of the drop to the end as shown in figure 7. The first differentiation of this curve gives the velocity in ft./sec. versus intervals of time. The second differentiation of the cg travel curve gives the acceleration in terms of ft./sec./sec. which is then converted into "g" (load factors) and is plotted as shown by curve 3, figure 7 (this figure gives the results of a 42" drop in which the maximum acceleration obtained was 8.2 g. This peak acceleration was obtained 1/10 of a second after release of the hook).

For accurate drop test results the rigidity of the jig must be approximately that of the actual fuselage. Also the moment of inertia of the distributed loads about the point of revolution of the jig must approach as closely as possible the moment of inertia of the actual airplane about the centerline of the landing gear or tail wheel axle. In order to reduce the vertical reactions to zero at the point of revolution of the jig it is readily observed that the "center of percussion" of the jig must be directly above the centerline of the axle of the landing wheel.



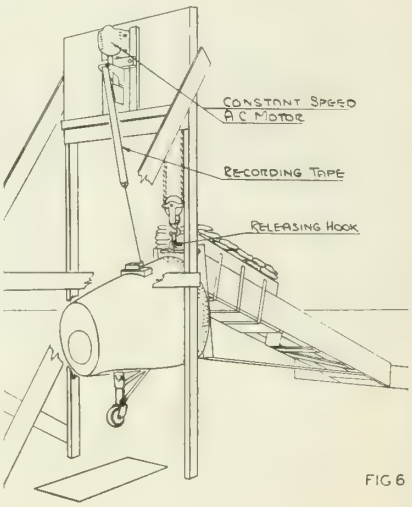
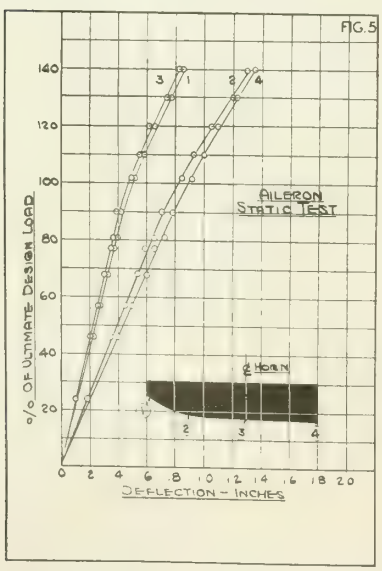



FIG 6



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# Relation of the Human Element to Safe Flying

*JAMES L. H. PECK*

● Investigations of aircraft accidents show that the "human element" is involved in the majority of accident causations, "pilot error" being the most prolific, yet subtle, source of accidents. In the latest Bureau of Air Commerce reports pilot errors accounted for 84.61% of the accidents occurring in miscellaneous flying operations during the first six months of 1936, and for 29.62% of the scheduled airline accidents during the full year 1936. The many quirks, attitudes, and idiosyncracies that comprise human nature, make attempts to analyze this causation a difficult endeavor. We cannot alter human nature, but we can lessen this danger by acquainting the pilot with facts concerning his mental and physical equipment, and the functions thereof. A more complete understanding may lead to clearer thought and more intelligent action.

In NACA report 357, an analysis method is used by the Bureau of Air Commerce in its investigations and the accident committee has set forth the various causes of accidents. Those which may be attributed to the human factor appear under "Personnel," and its sub-title, "Errors of Pilot," and under these headings, five immediate causes are given: (1) Error of judgment; (2) Poor technique; (3) Disobedience of orders; (4) Carelessness or negligence; and (5) Miscellaneous. Upon examination of these *immediate* causes, we come upon the *underlying* causes as actions leading to the commission of error and it is these that the author wishes to analyze and classify according to the conditions of mind which were probably prevalent at the time of some given difficult situation.

Most accidents due to pilot error are the result (direct, or indirect) of mental conditions or modes of which the pilot is not always aware. Three of these mental modes the author believes will embody the majority of causes under this discussion. Professors of psychology might find loopholes in these following classifications, but it is endeavored to present this discussion from the pilot's viewpoint.

In order to achieve this point, analogy is made with the conditions set down by the committee as underlying causes. In the analyses, in addition to the five immediate causes mentioned above, there are four underlying causes under two main headings:

(a)—Lack of Experience (total and recent): 1.—Lack of general experience; 2.—Lack of special experience.

(b)—Physical and Psychological (inherent or temporary): 1.—Disease or defect; 2.—Poor reaction.

All pilots may not be influenced by similar causes, and for this and other reasons, the connection of a particular accident with the proper mental mode will prove difficult. However, in the analyses, the cases cited run true to form.

### Perplexity

Perhaps most aircraft accidents are a result of perplexity. This condition may be aptly defined as ignorance, or lack of necessary information, and the by-product of inexperience. When a pilot encounters conditions with which he is unfamiliar, the reaction may be bewilderment. Pilots young in flying experience frequently come into this category, though experienced pilots may also be included.

Point 1 under "a" (lack of experience) includes the fundamentals of flying, *i.e.*, landings, take-offs, and general air work. If the pilot has not had sufficient practice to acquire the necessary experience to have avoided accident, he lacks total general experience. If he does not practice these general problems frequently enough, he lacks recent general experience. Any ability formerly acquired is diminished through lack of practice.

In the more advanced phases of flying, (cross-country, night, instrument and beam) the pilot with too little training or practice lacks total special experience. If he has too infrequently engaged in practice, he lacks recent special experience. Thus, in this application, the term "lack of experience" is extremely broad.



*Acme photo*

***This type of flying requires skill built up by a process of subordinating the conscious mind. The photo shows the German Count Hagenburg flying inverted, near the ground***

Under this same mental mode we may also discuss points 1 and 2 of the immediate causes. Point 1, error of judgment, would more reasonably be associated with perplexity and lack of experience than with other causes, though this error may be caused by the physical defect of poor reaction.

In this discussion the stigmatization of "poor judgment" seems to be pointless. All of us, as pilots, appreciate it means not making the "best" decision under prevailing circumstances. Judgment is appraised in relation to a given situation, and consistently good judgment is the by-product of experience. In a given case can we always be sure which is good or poor judgment, save by the evidence of success or failure? Generally, being too slow or too quick to react does not involve judgment, but situation. In such cases it is not so much the wrong decision, as lack of *any* decision, that brings about trouble.

Point 2, under immediate causes, "poor technique" also more reasonably would be associated with lack of experience than with other causes, though this fault may be brought about by physical defect, poor reaction, faulty habits, or improperly supervised instruction. Poor technique from the pilot's viewpoint, is merely poor flying due to lack of skill and coordination. From the psychologist's viewpoint, technique, good or poor, is the physical expression of the mental decisions which have been made.

Cost factor may also be considered somewhat responsible for many of the faults upon which poor technique is founded. The majority of the country's better flying schools are approved by the Bureau. There are, however, good schools and capable instructors operating in the unapproved category. Many of these unapproved schools are well attended because they offer instruction at reasonable cost that proves attractive to students. More prospective fliers would undoubtedly attend the better schools but for the added expense.

Though a student may be fortunate enough to have an excellent pilot as his instructor, his training may still prove inadequate for him to develop good technique, because many good pilots are unsuited for instructional work.

### Refractoriness

We find a high percentage of accidents under this mode, or condition of mind. This is a condition of stubbornness and

(*Continued on page* 58)

# THEORY OF FLEXURE

## applied to the analysis of wings of box type of construction

*GUY L. BRYAN, Jr., M. C. E.*
The Glenn L. Martin Company

**In wings of the "box type" or "shell type" of construction, the material forming the top and bottom surfaces is utilized to resist bending loads, two or more webs connect these surfaces and carry vertical shear loads, while the entire periphery of the box is used to resist torsion. Many of these wings have been analyzed by the use of simple beam formulas, a process that may lead to error in many cases. Any rational method of analysis must take into account the effect of the unsymmetrical shape of the cross-section and the unsymmetrical distribution of material. Several text-books on the mechanics of materials discuss this problem of unsymmetrical bending, but the methods used are laborious in their application. In this article a procedure is developed which is adapted to routine calculations, and which has been thoroughly tested.**

### General Formulas for Bending Stresses

● The general problem may be stated as follows:

*Given:* A straight beam of any cross-section and subjected to loads in any plane which includes the longitudinal axis of the beam.

(Definition: The longitudinal axis is the line which joins the centers of gravity of the various right sections. The object of this limitation is to eliminate the effects of torsion.)

*Required:* The intensity of normal stress at any point of a given right section, and the shear on any surface parallel to the longitudinal axis.

Let the beam have any cross-section, as in figure 1b.

Let $X$-$X$ and $Y$-$Y$ be any convenient set of rectangular axes passing through the center of gravity of the cross-section.

Let $dA$ be any infinitesimal element of area, of dimensions $dx$ and $dy$, distant $x$ and $y$ from axes $Y$-$Y$ and $X$-$X$ respectively.

Then $dA = (dx)(dy)$

Let $B$-$B$ be the plane of resultant bending moment at the section, inclined at any angle $\theta$ to axis $X$-$X$.

Let $M$ be the magnitude of this resultant bending moment.

Let $f_b$ be the intensity of normal stress on $dA$.

Let $N$-$A$ be the locus of points where $f_b = 0$ (i.e. the neutral axis) inclined at angle $\alpha$ to axis $X$-$X$.

Let $v$ be the perpendicular distance from $dA$ to the neutral axis $N$-$A$.

It is assumed that the normal stresses on the cross-section are distributed in accordance with the linear law, or Navier's hypothesis. This is expressed algebraically as

$$f_b = kv \qquad (1)$$

where $k$ is a constant.

In order that the section be in equilibrium, the following conditions must be satisfied.

(1) The total normal force on the cross-section must be equal to zero.

(2) The moments of the internal forces about axis $X$-$X$ must be equal to the moments of the external forces about that axis.

(3) The moments of the internal forces about axis $Y$-$Y$ must be equal to the moments of the external forces about that axis.

Expressing these conditions mathematically, the following equations are obtained:

$$\int\int (f_b)(dx)(dy) = 0 \qquad (2a)$$

$$\int\int (y)(f_b)(dx)(dy) = M\sin\theta = M_x \qquad (2b)$$

$$\int\int (x)(f_b)(dx)(dy) = M\cos\theta = M_y \qquad (2c)$$

where $M_x$ and $M_y$ are the components of resultant bending moment about axes $X$-$X$ and $Y$-$Y$ respectively.

From the geometry of figure 1b it is evident that

$$v = y\cos\alpha - x\sin\alpha$$

Substituting this in (1),

$$f_b = k(y\cos\alpha - x\sin\alpha)$$

Substituting this value of $f_b$ in (2a)

$$\int\int k(y\cos\alpha - x\sin\alpha)(dx)(dy) = 0.$$

or $k\cos\alpha\int\int (y)(dx)(dy) - k\sin\alpha\int\int (x)(dx)(dy) = 0.$

But $\int\int (y)(dx)(dy)$ and $\int\int (x)(dx)(dy)$ are both equal to zero, as $X$-$X$ and $Y$-$Y$ are axes through the center of gravity of the section.

Therefore (2a) is satisfied.

Substituting the value of $f_b$ in (2b)

$$\int\int (y)(k)[(y\cos\alpha - x\sin\alpha)](dx)(dy) = M\sin\theta.$$

or $k\cos\alpha\int\int (y^2)(dx)(dy) - k\sin\alpha\int\int (xy)(dx)(dy) = M\sin\theta.$

But $\int\int (y^2)(dx)(dy) = I_x$ = moment of inertia of cross-section about axis $X$-$X$.

And $\int\int (xy)(dx)(dy) = I_{xy}$ = product of inertia of cross-section about axes $X$-$X$ and $Y$-$Y$.

Therefore

$$k I_x\cos\alpha - k I_{xy}\sin\alpha = M\sin\theta \qquad (3)$$

Substituting the value of $f_b$ in (2c)

$$\int\int (x)(k)[(y\cos\alpha - x\sin\alpha)](dx)(dy) = M\cos\theta.$$

or $k\cos\alpha\int\int (xy)(dx)(dy) - k\sin\alpha\int\int (x^2)(dx)(dy) = M\cos\theta.$

But $\int\int (x^2)(dx)(dy) = I_y$ = moment of inertia of cross-section about axis $Y$-$Y$.

Therefore

$$k I_{xy}\cos\alpha - k I_y\sin\alpha = M\cos\theta \qquad (4)$$

Dividing (3) by (4)

$$M\sin\theta/M\cos\theta = k(I_x\cos\alpha - I_{xy}\sin\alpha)/k(I_{xy}\cos\alpha - I_y\sin\alpha)$$

or

$$\tan\theta = (I_x\cos\alpha - I_{xy}\sin\alpha)/(I_{xy}\cos\alpha - I_y\sin\alpha)$$

From this equation $\tan\alpha$ may be solved as follows:

$$\tan\alpha = (I_x - I_{xy}\tan\theta)/(I_{xy} - I_y\tan\theta) \qquad (5a)$$

$$= (I_x\cot\theta - I_{xy})/(I_{xy}\cot\theta - I_y) \qquad (5b)$$

$$= (I_x\cos\theta - I_{xy}\sin\theta)/(I_{xy}\cos\theta - I_y\sin\theta) \qquad (5c)$$

As all the quantities on the right side of these equations in the above are known from the conditions of the problem, the slope of the neutral axis can be found. Forms (5a) and (5b) become indeterminate for certain values of $\theta$, but (5c) is perfectly general.

From (4),

$$k = M\cos\theta/(I_{xy}\cos\alpha - I_y\sin\alpha)$$

Substituting this value of $k$ in the equation for $f_b$

$$f_b = [(M\cos\theta)/(I_{xy}\cos\alpha - I_y\sin\alpha)](y\cos\alpha - x\sin\alpha)$$

$$= M\cos\theta\,(y - x\tan\alpha)/(I_{xy} - I_y\tan\alpha)$$

Substituting the value of $\tan\alpha$ from (5c), this becomes

$$f_b = M\cos\theta\,\{y - [x(I_x\cos\theta - I_{xy}\sin\theta)/(I_{xy}\cos\theta - I_y\sin\theta)]\}/\{I_{xy} - [I_y(I_x\cos\theta - I_{xy}\sin\theta)/(I_{xy}\cos\theta - I_y\sin\theta)]\}$$

Therefore

$$f_b = M\cos\theta\{-y(I_y\sin\theta - I_{xy}\cos\theta) - x(I_x\cos\theta - I_{xy}\sin\theta)\}/\{I^2_{xy}\cos\theta - I_{xy}I_y\sin\theta - I_xI_y\cos\theta + I_{xy}I_y\sin\theta\}$$

$$= M\{[(I_y\sin\theta - I_{xy}\cos\theta)y + (I_x\cos\theta - I_{xy}\sin\theta)x]/(I_xI_y - I^2_{xy})\} \qquad (6)$$

This equation is the most general expression for normal stress at any point in the cross-section.

If $X$-$X$ and $Y$-$Y$ are principal axes of inertia of the cross-section, $I_{xy}$ will be zero about these axes, and (6) becomes

$$f_b = M\sin\theta(y/I_x) + M\cos\theta(x/I_y)$$

$$= (M_x)(y/I_x) + (M_y)(x/I_y) \qquad (6a)$$

For the extremely restricted case where $I_{xy} = 0$ and $\theta = 90°$

$$f_b = (M_x)\ (y/I_x) \qquad (6b)$$

which is the well-known equation for bending stresses in a

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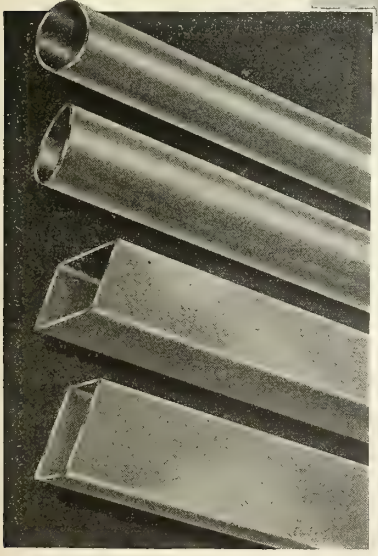
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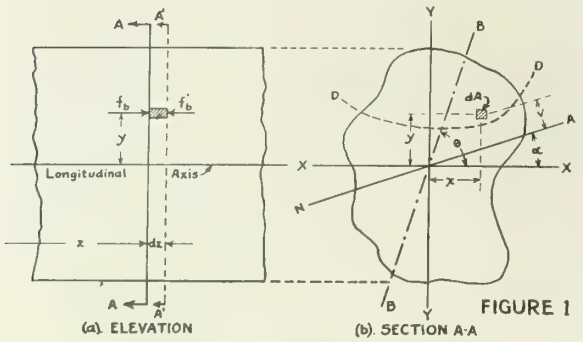



FIGURE 1

simple beam. This formula is valid only when the cross-section is symmetrical about the $Y$-$Y$ axis and the plane of resultant moment contains this axis. It is of practical importance because so many problems involve these conditions. The limitations of its application should always be kept in mind.

So far nothing has been said about algebraic signs in the equations derived.

Let positive bending moment be defined as follows:

(1) $M_x$ is positive when it causes compression above axis $X$-$X$.

(2) $M_y$ is positive when it causes compression to right of axis $Y$-$Y$.

Using this convention and using the customary signs for $x$ and $y$, (6a) becomes

$$f_b = -(M_x)(y/I_x) - (M_y)(x/I_y) \quad \ldots\ldots (6a)'$$

and (6) becomes

$$f_b = [[(M_y I_{xy} - M_x I_y)y + (M_x I_{xy} - M_y I_x)x]/(I_x I_y - I^2_{xy})] \quad \ldots\ldots (7)$$

Now let $C_1 = I_{xy}/(I_x I_y - I^2_{xy})$

$C_2 = I_y/(I_x I_y - I^2_{xy})$

$C_3 = I_x/(I_x I_y - I^2_{xy})$

Substituting these values in (7)

$$f_b = (C_1 M_y - C_2 M_x)y + (C_1 M_x - C_3 M_y)x \quad \ldots\ldots (8)$$

This form is most convenient for routine use, as will be seen in the practical application shown later.

### General Formulas for Shearing Stresses

Referring again to figure 1, suppose a surface $D$-$D$ be passed through the section parallel to the longitudinal axis and the total shearing force on this surface be required.

Consider the equilibrium of an element of the beam of area $[(dx)(dy)]$ and coordinates $[x, y]$ lying above $D$-$D$ and included between two right sections $A$-$A$ and $A'$-$A'$ which are an infinitesimal distance $[dz]$ apart. The normal force acting on this element at section $A$-$A$ will be

$$= (f_b)(dx)(dy)$$

Substituting the value of $f_b$ from (6) this becomes

$$\triangle F = M[[(I_y \sin\theta - I_{xy}\cos\theta)y + (I_x \cos\theta - I_{xy}\sin\theta)x]/(I_x I_y - I^2_{xy})](dx)(dy)$$

and $F = \int\int \triangle F = M[[(I_y \sin\theta - I_{xy}\cos\theta)\int\int (y)(dx)(dy) + (I_x \cos\theta - I_{xy}\sin\theta)\int\int x\,dx\,dy]/(I_x I_y - I^2_{xy})]$

$$= M[[(I_y \sin\theta - I_{xy}\cos\theta)Q_x + (I_x \cos\theta - I_{xy}\sin\theta)Q_y]/(I_x I_y - I^2_{xy})]$$

where $\int\int (y)(dx)(dy) = Q_x$

= statical moment of area above $D$-$D$ about $X$-$X$.

$\int\int (x)(dx)(dy) = Q_y$

= statical moment of area above $D$-$D$ about $Y$-$Y$.

Similarly the total force at section $A'$-$A'$ above surface $D$-$D$ is equal to

$$F' = M'[[(I_y \sin\theta - I_{xy}\cos\theta)Q_x + (I_x \cos\theta - I_x \sin\theta)Q_x]/(I_x I_y - I^2_{xy})]$$

If $M \neq M'$ there will be an unbalanced force, equal to $(F$-$F')$, above $D$-$D$ parallel to the longitudinal axis and equal to

$$(M\text{-}M')[[(I_y \sin\theta - I_{xy}\cos\theta)Q_x + (I_x \cos\theta - I_{xy}\sin\theta)Q_y]/(I_x I_y - I^2_{xy})]$$

This will cause a shearing force on $D$-$D$. Let $s_H$ be the value of this shear in lbs./unit length of beam.

Then $(s_H)(dz) = (M - M')[[(I_y \sin\theta - I_{xy}\cos\theta)Q_x + (I_x \cos\theta - I_{xy}\sin\theta)Q_y]/(I_x I_y - I^2_{xy})]$

But $(M - M')/dz = dM/dz = V$ = transverse shear at section.

Therefore $s_H = V[[(I_y \sin\theta - I_{xy}\cos\theta)Q_x + (I_x \cos\theta - I_{xy}\sin\theta)Q_y]/I_x I_y - I^2_{xy}] \quad \ldots\ldots (9)$

This is the general equation for shear on any surface parallel to the longitudinal axis.

If $X$-$X$ and $Y$-$Y$ are principal axes of inertia, then $I_{xy} = 0$ and (9) becomes

$$s_H = V_x (Q_x/I_x) + V_y (Q_y/I_y) \quad \ldots\ldots (9a)$$

where $V_x$ = component of transverse shear parallel to $Y$-$Y$.

$V_y$ = component of transverse shear parallel to $X$-$X$.

For the limited case when $I_{xy} = 0$ and $\theta = 90°$

$$s_H = (V_x)(Q_x/I_x) \quad \ldots\ldots (9b)$$

which is the familiar equation for these special conditions and subject to the same limitations as pointed out in the discussion of (6b).

Using values of $C_1$, $C_2$, and $C_3$ as defined before, (9) reduces to the form

$$s_H = (C_2 V_x - C_1 V_y)Q_x + (C_3 V_y - C_1 V_x)Q_y \quad \ldots\ldots (10)$$

If positive shear is given the usual definition, i.e. the resultant load to the left of the section acts upwards, then the above equation is correct as to sign.

### General Theory of Flexure Applied to a Design

As a practical example of this method, one of the wing sections of the *China Clipper* will be investigated.

As shown in figure 2, the section is made up of corrugated sheet on the top connected to the top beam chord angles at the corners: the bottom surface is made up of comparatively heavy lower beam chords connected by flat sheet. The front and rear beams have webs of the "tension field" type. The leading and trailing edges are assumed to be incapable of carrying stress, and the portion between the front and rear beams is considered as a box-type beam.

For purposes of computation, the top chord is divided into 7 strips and the area of each assumed concentrated at its c.g. The bottom is divided into 4 parts and the same assumption made. The areas of the top and bottom beam chords are also assumed concentrated at their centers of gravity.

The reference axes and symbols used are shown in figure 2. The detailed computation of the section properties is shown in Table 1. This procedure gives the values of the constants $C_1$, $C_2$ and $C_3$.

$C_1 = -1846/142509160 = -12.95 \times 10^{-6}$

$C_2 = 29236/142509160 = 205.15 \times 10^{-6}$

$C_3 = 4991/142509160 = 35.02 \times 10^{-6}$

For purposes of illustration, two loading conditions will be investigated and bending stresses and neutral axis location determined. In finding the stresses, the distance to the extreme fiber is taken, which means that to the values of $x$ and $y$ in Table 1 the distance of the centroid of each point from the skin line must be added.

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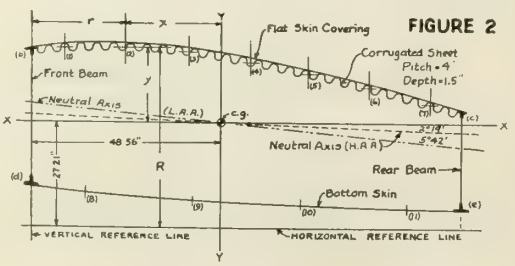
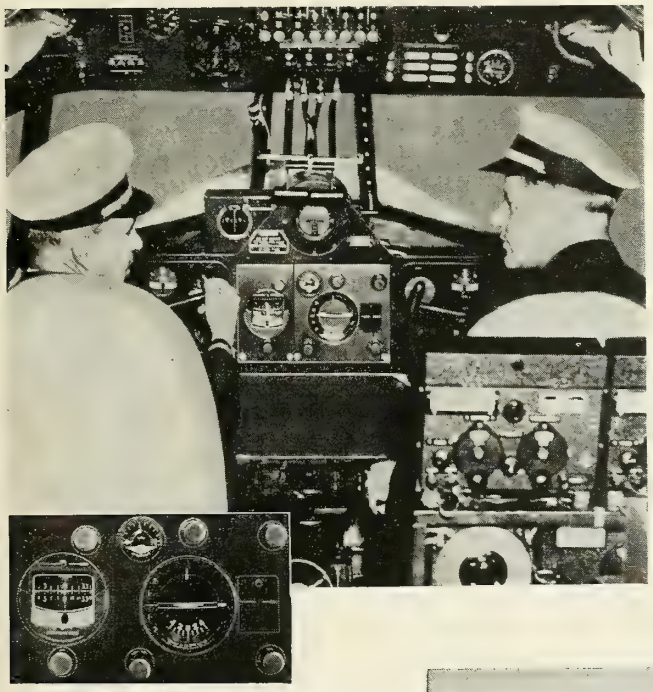



FIGURE 2

# The value of DOWMETAL — to the aeronautical engineer, the aircraft manufacturer, pilot and owner — cannot be overemphasized. Offering lightness of a full third over aluminum with comparable strength, toughness and durability, DOWMETAL has opened up ever widening opportunities for greater performance and safety in aeronautics.



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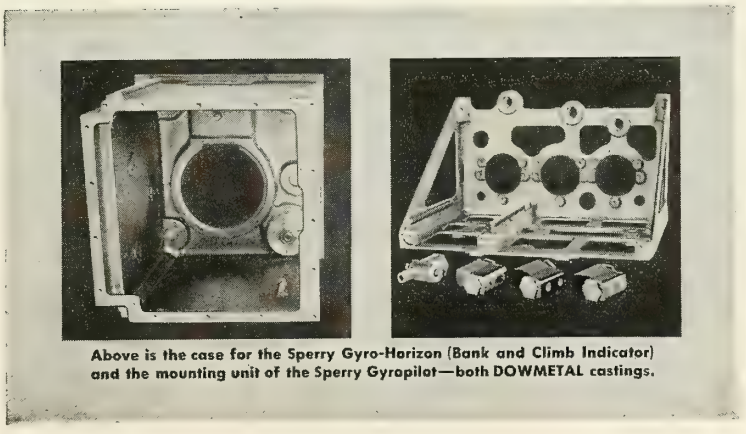
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Above is the case for the Sperry Gyro-Horizon (Bank and Climb Indicator) and the mounting unit of the Sperry Gyropilot—both DOWMETAL castings.

*(Continued from preceding page)*

**High Angle of Attack Loading Condition**

Beam bending moment = $(+8.42)\ (10^6)$ in. lbs., acting perpendicular to axis $X\text{-}X = M_x$

Chord bending moment = $(-1.136)\ (10^6)$ in. lbs., acting perpendicular to axis $Y\text{-}Y = M_y$

$$\tan\theta = +8.42/-1.136 = -7.4124$$

From (5a), $\tan\alpha = 4991 - [(-(1846)(-7.4121)]/-1846 - [(29236)(-7.4124)] = -.04027$

Therefore $\alpha = -2°19'$ and the neutral axis lies in the second and fourth quadrants as shown in figure 2.

Substituting in (8), $f_b = [(-12.95)(-1.136) - (205.15)(8.42)]y + [(-12.95)(842) - (35.02)(1.136)]x = -1713y - 69.3x$

The stresses at different points of the cross-section are shown in Table 2.

TABLE 2

| Point | x | y | $-69.3x$ | $-1713y$ | Total Stress |
|---|---|---|---|---|---|
| 1 | −40.56 | +19.49 | +2811 | −33386 | −30575 |
| 2 | −24.56 | +19.69 | +1702 | −33729 | −32027 |
| 3 | − 8.56 | +18.29 | + 593 | −31331 | −30738 |
| 4 | + 7.44 | +16.09 | − 516 | −27562 | −28078 |
| 5 | +22.44 | +13.29 | −1555 | −22766 | −24321 |
| 6 | +37.44 | + 9.84 | −2595 | −16856 | −19451 |
| 7 | +53.44 | + 5.36 | −3703 | − 9182 | −12885 |
| b | −48.56 | +18.34 | +3365 | −31416 | −28051 |
| c | +61.44 | + 2.94 | −4258 | − 5036 | − 9294 |
| d | −48.56 | −17.41 | +3365 | +29823 | +33188 |
| e | +61.44 | −23.21 | −4258 | +39759 | +35501 |

**Low Angle of Attack Loading Condition**

Beam bending moment = $(+\ 5.86 \times 10^6) = M_x$

Chord bending moment = $(+\ 1.304 \times 10^6) = M_y$

$$\tan\theta = +\ 5.86/1.304 = +\ 4.4922$$

$$\tan\alpha = 4991 - [(-\ 1846 \times 4.4922)]/(-\ 1846) - 29236 \times 4.4922) = -\ .0998$$

and $\alpha = -\ 5°42'$

Therefore the neutral axis lies in the second and fourth quadrants, as shown in figure 2.

$f_b = [-(12.95)(1.304) - (205.15)(5.86)]y + [-(12.95)(5.86) - (35.02)(1.304)]x = -1219.36y - 121.56x$

The stresses at different points of the cross-section are shown in Table 3.

TABLE 3

| Point | x | y | $-121.56x$ | $-1219.36y$ | Total Stress |
|---|---|---|---|---|---|
| 4 | + 7.44 | +16.09 | − 904 | −19620 | −20524 |
| 5 | +22.44 | +13.29 | −2729 | −16205 | −18934 |
| 6 | +37.44 | + 9.84 | −4551 | −11999 | −16550 |
| 7 | +53.44 | + 5.36 | −6496 | − 6536 | −13032 |
| c | +61.44 | + 2.94 | −7469 | − 3585 | −11054 |
| d | −48.56 | −17.41 | +5903 | +21229 | +27132 |
| e | +61.44 | −23.21 | −7469 | +28301 | +20832 |

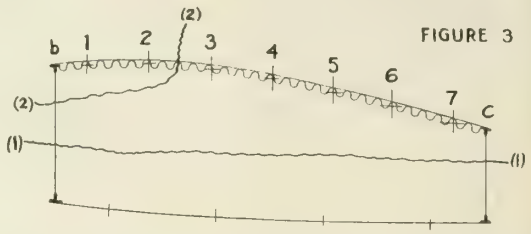



FIGURE 3

Next the horizontal shearing stresses on the beam webs will be computed. Referring to figure 3, a section (1-1) is taken which passes through both beam webs. The shearing stresses are found from (10).

**High Angle of Attack Loading Condition**

Beam shear = $(+\ 45.2)(10^3)$ in. lbs., perpendicular to axis $X\text{-}X = V_x$

Chord shear = $(-\ 6.1)(10^3)$ in. lbs., perpendicular to axis $Y\text{-}Y = V_y$

$$s_H = \{[(205.15)(45.2) - (12.95)(6.1)]\ 138.54 + [(-\ 6.1)(35.02) + (12.95)(45.2)](25.83)\}\{10^{-3}\}$$

= 1283 lbs./in. of length of beam.

**Low Angle of Attack Loading Condition**

Beam shear = $(+\ 31.3)(10^3)$ in. lbs. = $V_x$

Chord shear = $(+\ 6.95)(10^3)$ in. lbs. = $V_y$

$$s_H = \{[(205.15)(31.3) + (12.95)(6.95)]\ [138.54] + [(6.95)(35.02) + (12.95)(31.3)]\ [25.83]\}\{10^{-3}\}$$

= 916 lbs./ in. of beam.

The above computations give no indication of the distribution of shear between front and rear webs, only the total shear on both webs. A detailed analysis of this distribution (which will not be shown here) indicates that for box beams of this type with beams in usual locations the intensity of horizontal shearing stress is practically the same on both webs. Little error is made by assuming the shear equally divided between front and rear webs.

Having the shearing stress on the webs, the shear at any other point of the cross-section can be found. For example, suppose it is desired to find the shear between points 2 and 3 in figure 3. The amount of horizontal shear contributed by points b, 1, and 2 can be found by substituting in (10) the $\Sigma Ay$ and $\Sigma Ax$ values of these three points in place of $Q_x$ and $Q_y$. Subtracting the value thus found from the shearing stress on the front web will give the shearing stress at the point desired.

This method can be extended when it is desired to find the shear at any point of the cross section.

TABLE 1. WING SECTION PROPERTIES

| Pt. | Area | R | AR | r | Ar | x | Ax | $Ax^2$ | y | Ay | $Ay^2$ | Axy |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.352 | 45.95 | 62.12 | 8 | 10.8 | −40.56 | −54.84 | 2224 | +18.74 | +25.34 | 475 | −1028 |
| 2 | 1.352 | 46.15 | 62.40 | 24 | 32.4 | −24.56 | −33.21 | 816 | +18.94 | +25.61 | 485 | − 629 |
| 3 | 1.369 | 44.75 | 61.26 | 40 | 54.8 | − 8.56 | −11.72 | 100 | +17.54 | +24.01 | 421 | − 206 |
| 4 | 1.377 | 42.55 | 58.59 | 56 | 77.1 | + 7.44 | +10.24 | 76 | +15.34 | +21.12 | 324 | + 157 |
| 5 | 1.124 | 39.75 | 44.68 | 71 | 79.8 | +22.44 | +25.22 | 566 | +12.54 | +14.09 | 177 | + 316 |
| 6 | .871 | 36.30 | 31.62 | 86 | 74.9 | +37.44 | +32.61 | 1221 | + 9.09 | + 7.92 | 72 | + 296 |
| 7 | .882 | 31.82 | 28.07 | 102 | 90.0 | +53.44 | +47.13 | 2519 | + 4.61 | + 4.07 | 19 | + 217 |
| b | .808 | 45.05 | 36.40 | 0 | 0 | −48.56 | −39.24 | 1905 | +17.84 | +14.41 | 257 | − 700 |
| c | .808 | 29.65 | 23.96 | 110 | 88.9 | +61.44 | +49.64 | 3050 | + 2.44 | + 1.97 | 5 | + 121 |
| Total Top | 9.943 | | 409.10 | | | | +25.83 | | | +138.54 | | |
| a | 3.219 | 10.30 | 33.16 | 0 | 0 | −48.56 | −156.31 | 7590 | −16.91 | −54.43 | 920 | +2643 |
| e | 1.918 | 4.50 | 8.63 | 110 | 211.0 | +61.44 | +117.84 | 7240 | −22.71 | −43.56 | 989 | −2676 |
| 8 | .489 | 8.75 | 4.28 | 13.75 | 6.7 | −34.81 | − 17.02 | 592 | −18.46 | − 9.03 | 167 | + 314 |
| 9 | .489 | 6.95 | 3.40 | 41.25 | 20.2 | − 7.31 | − 3.57 | 26 | −20.26 | − 9.91 | 201 | + 72 |
| 10 | .489 | 5.70 | 2.79 | 68.75 | 33.6 | +20.19 | +9.87 | 199 | 21.51 | −10.52 | 226 | − 212 |
| 11 | .489 | 4.45 | 2.18 | 96.25 | 47.1 | +47.69 | + 23.32 | 1112 | −22.76 | −11.13 | 253 | − 531 |
| Total Bottom | 7.093 | | 54.44 | | | | | | | −138.58 | | |
| TOTAL | 17.036 | | 463.54 | | 827.30 | | | 29236 | | | 4991 | −1846 |

Center of Gravity . = 463.54/17.036 = 27.21" above reference line
= 827.30/17.036 = 48.56" to right of reference line

$I_x = 4991$
$I_y = 29236$
$I_{xy} = -1846$
$Q_x = +138.54$
$Q_y = +\ 25.83$

$I_xI_y - I^2_{xy} = (4991)(29236) - (-1846)^2 = 142,509,160$



**N Y-1,** one of the early Consolidated Trainers. These planes were revered throughout the service for their rugged qualities and their ability to defy unfavorable flying conditions. And many a Navy pilot who will eventually fly the new P B Y-1 Patrol Bombers took his first lesson on these veterans.



# *Since its earliest days* CONSOLIDATED HAS PLAYED SAFE WITH GOODRICH

CONSOLIDATED—builder of military planes that are famous for dependability and ruggedness—began using Goodrich equipment early in its successful career. From the days when service fledglings learned to fly on the veteran Consolidated "P T" Trainers, Goodrich Tires and other products have been time-tested by Consolidated in many types of Army and Navy service.

And no proof of the dependability of Goodrich Airplane Silvertown Tires is more striking than their use today on the beaching gear of the giant Consolidated Patrol Bombers. Supporting more than 10 tons, these tires are exposed to scorching tropical suns and quick plunges into cold water, a series of instantaneous coolings and rapid re-heatings that are a test of stamina unknown to tires on land planes.

Because Goodrich builds equipment for the leading pilots, plane makers and air lines, Goodrich builds for every aviation need. No plane is too small, no job too unimportant to be without the extra margin of safety and efficiency that Goodrich Aviation Products will give. See your nearest Goodrich dealer or write to Dept. 632, Aeronautical Division of The B. F. Goodrich Co., Akron, Ohio, for complete information about Goodrich Airplane Silvertowns and over 40 other Goodrich Aviation Products.



**P T-1, A FAMOUS "OLD-TIMER"**

Many a flyer whose name is celebrated today got his first taste of flying from the cockpit of the famed Consolidated P T-1 Trainer. Training units used today by Army and Navy instructors are the outgrowth of these successful Consolidated designs.



**THE PBY-1,** Patrol Bomber Airboat, one of 176 such units now being built by Consolidated Aircraft Corp., for U. S. Navy Service. Recently, 12 of these air giants made the longest non-stop formation flight in aviation history, covering 2,553 miles from San Diego to Honolulu. In addition to using Goodrich Airplane Tires for beaching gear, the P B Y-1 uses many of the more than 40 other Goodrich Aviation Products.




# Goodrich *Airplane* Silvertowns

## THE SAFEST AIRPLANE TIRE EVER BUILT

Over 40 Rubber Products for Airplanes — including Tires — Tail Wheels — Abrasion Shoes — De-Icers — Matting — Rubber Hose — Grommets — Shock Absorber Cord — A Complete Line of Rubber Aeronautical Accessories.



*Taking star observations by the direct-view method with the Position Finder*

# Fairchild-Hagner Position Finder

***JOHN C. OCHOCKI***

Fairchild Aerial Camera Corp.

● The Fairchild-Hagner Position Finder literally functions as a portable planetarium, and reproduces with accuracy the motion of any celestial body. One of the difficult phases of navigation is the ability to visualize the actual forms of spherical constructions which are shown as drawings or diagrams. The position finder actually creates the simulation of such constructions in a three-dimensional form, and permits motion of the celestial bodies to be reproduced in such a way as to make evident the meaning of each variable concerned in the problem.

The instrument is based on the co-ordinates of any celestial body—viz., azimuth, declination and hour angle. These factors, instead of remaining numerical quantities, are given tangible form in the shape and setting of arcs to be manipulated by the operator.

On completing the problem one sees the relation of these co-ordinates to each other at the instant of the observation. The amount of each factor is set by hand, and the final alignment of two small telescopes completes the solution. Due to the fact that the finder simulates the relative movements of celestial bodies, it may be used indefinitely, since these never change.

Instructing the student in the definition of the co-ordinates and proper manipulation of the finder is all that is necessary for proficiency. The marked saving in total time required is obvious.

The more written work to be done in the solution, the greater is the possibility for error. In actual practice, a careful check requires almost as much time as another complete solution. For this reason, careful navigators often take two observations almost simultaneously, and work them out together. With the position finder, one good observation with proper settings and adjustments will give the most accurate position obtainable. based on whether the observer is using a certain dead reckoning position or merely an assumed position. With time and co-ordinate factors being accurate, the instrument will give an average accuracy of between 3 to 4 miles of an absolute position, any error being due principally to inaccurate alignment of the two telescopic indices. With little practice this error may be greatly reduced.

### Construction

Construction of the finder is as simple as the principle on which it is based. Five finely-engraved arcs, pivoted in the proper relationship, and provided with the necessary riders and optical devices, comprise the operating mechanism. The arcs, despite their precision, are engraved with large figures and may be read, even in poor light, to within half a minute.

The movable arcs are constructed from solid nickel silver with the vernier gear teeth cut integrally with the arc by a special precision gear cutting machine. Altitude and declination riders are of stainless steel and other non-corrosive materials, and are shaped to accurately fit the arcs over large bearing areas. The base is constructed of bronze, with the principal axes of the instrument aligned so as to intersect at a common point with a maximum error of .0002" and ½ minute of angle. Vernier gears are provided with backlash adjustments that permit elimination of errors due to wear caused by usage. The bubble cell is stainless steel and is provided with levelling screws accurately set at the factory.

### Taking a Sight for Altitude

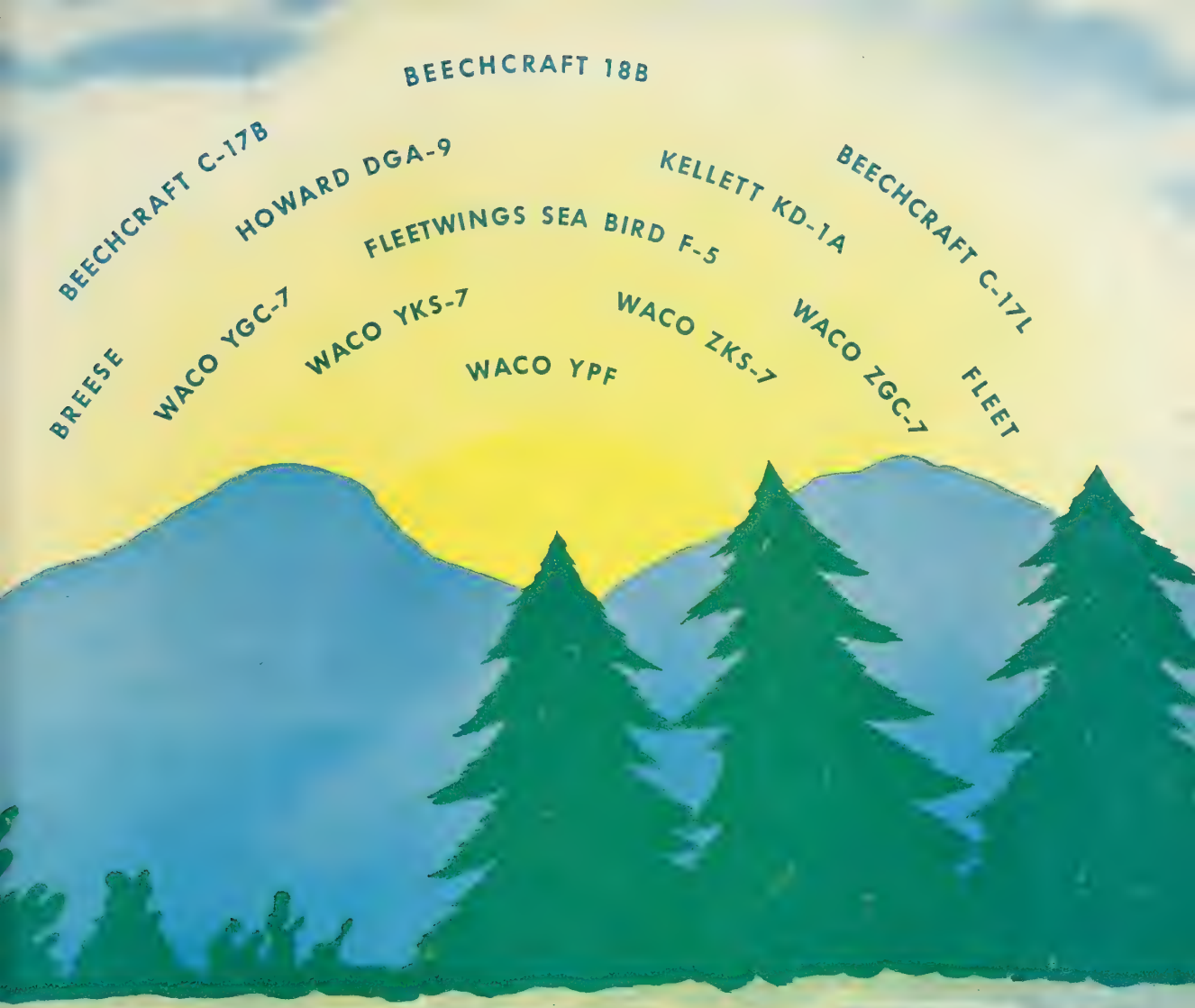
For the sun or moon, the observing device of the instrument is "indirect" reading. A clear image of the sun or moon is projected by the rider telescope on the surface of the horizon plane and bubble glass. This image is centered on the artificial horizon line of the instrument by moving the azimuth circle and altitude rider. In actual practice, the azimuth circle is set to a convenient value and the image is moved laterally by swinging the instrument slightly. With the bubble centered, the altitude rider is moved until coincidence of the image of the sun or moon is secured with the horizon line of the instrument. The time is noted at the instant of coincidence, and the value of altitude of the celestial body may then be secured from the altitude rider index and vernier. This is subject to correction for refraction only, the semi-diameter correction being unnecessary.

This method permits placing the instrument in the observer's lap, or on a tripod or gimbal mount. It can be adequately supported in the lap, or on the knees of the observer, and the task of holding the bubble steady is not difficult.

A special star device has been designed for the purpose of taking star altitudes.

The value of altitude is indicated directly on the altitude arc during the actual observation. The latitude of the observer is applied by inclination of the sextant horizon plane towards the pole of the instrument. Application of the declination to the solution is made by extracting this co-ordinate from the Nautical Almanac and indicating its value on the celestial meridian arc by the declination rider. Alignment of the declination and altitude telescopes with one rapid manipulation of the celestial

*(Continued on following page)*




THE rapidly increasing number of Aircraft Manufacturers standardizing n Jacobs Engines; offering them as op- onal equipment; and designing new models owered by Jacobs, is indicative f the industry's appreciation of ne value to them of our *years of manufacturing experience — hundreds of thousands of hours of operating experience — conscientious service policies — comparatively low initial cost — economy of operation — superior performance per rated h. p. — ruggedness and simplicity of design.*

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# *Since this Famous Flight* 10 YEARS AGO



Transcontinental & Western Air
Douglas DST Skysleeper
Powered By Wright Cyclones



American Airlines
Douglas "Flagship" Sleeper
Powered By Wright Cyclones



Eastern Air Lines
"Great Silver Fleet"
Powered By Wright Cyclones

In the brief span of ten years since Colonel Charles A. Lindbergh made the historic non-stop, solo flight from New York to Paris, in his Wright Whirlwind-powered "Spirit of St. Louis," air transportation has had a very phenomenal growth.

Passenger traffic in the United States alone has increased from a few thousand airline passengers in 1927 to over a million in 1936. Plane miles flown over America's leading air routes have increased from a few hundred thousand miles in 1927 to over 64,000,000 miles in 1936—43½% of the world's total commercial transport flying.

Wright aircraft engines have played a vital part in the tremendous growth of air transportation throughout the world. Today Wright Cyclone and Whirlwind engines not only power the majority of the leading airlines of the United States, but the fastest airline equipment operated by leading airlines throughout the world.

### *Famous Cyclone-powered Lindbergh Flights*

1931—Colonel and Mrs. Charles A. Lindbergh's flight from Washington, D. C. to Tokyo, Japan in a Cyclone-powered Lockheed Sirius Monoplane, equipped with floats.

1933—Colonel and Mrs. Charles A. Lindbergh's survey flight for Pan American Airways, in their Cyclone-powered Lockheed Sirius, to Europe, Africa, South America and return. On this flight the Lindberghs visited 31 countries and colonies—spanned both the North and South Atlantic Ocean—covered a total of 30,000 miles!



Pan American Airways
Douglas DC-2 Airliner
Powered By Wright Cyclones



K. L. M. (Royal Dutch Airlines)
Douglas DC-2 Airliner
Powered By Wright Cyclones



Swiss Air Lines
Douglas DC-2 Airliner
Powered By Wright Cyclones

*"Fly With Wright the World Over"*

# WRIGHT

AERONAUTICAL CORPORATION
PATERSON NEW JERSEY

A DIVISION OF CURTISS-WRIGHT CORPORATION

(*Continued from preceding page*)
meridian arc and the horizon plane automatically sets the value of the local hour angle and the azimuth on their respective protractors.

The entire operation can be accomplished in less than a minute by a person unversed in navigation, who has been instructed in reading the arcs and the simple mechanical operation of the clutches and verniers. One subtraction or addition completes the solution.

In illustrating the various uses of this position finder its method of application in the solution of a position line is chosen due to the popularity of this system in modern navigation practice. Since the merits of the finder permit its application to any solution involving the spherical triangle, the choice of a particular method is left to the operator.

An assumed position is the result of certain decisions made by the navigator and justified and governed by the readings of whatever direction and speed instruments he has available. Under certain unfavorable conditions it may be no more than a good guess. With the Fairchild-Hagner Position Finder he is prepared to test the accuracy of his conclusions (or assumed position co-ordinates) by comparing them with the angular relation of celestial co-ordinates of a chosen celestial body whose movement and position has been scientifically pre-computed in the Nautical Almanac.

The procedure is as follows:

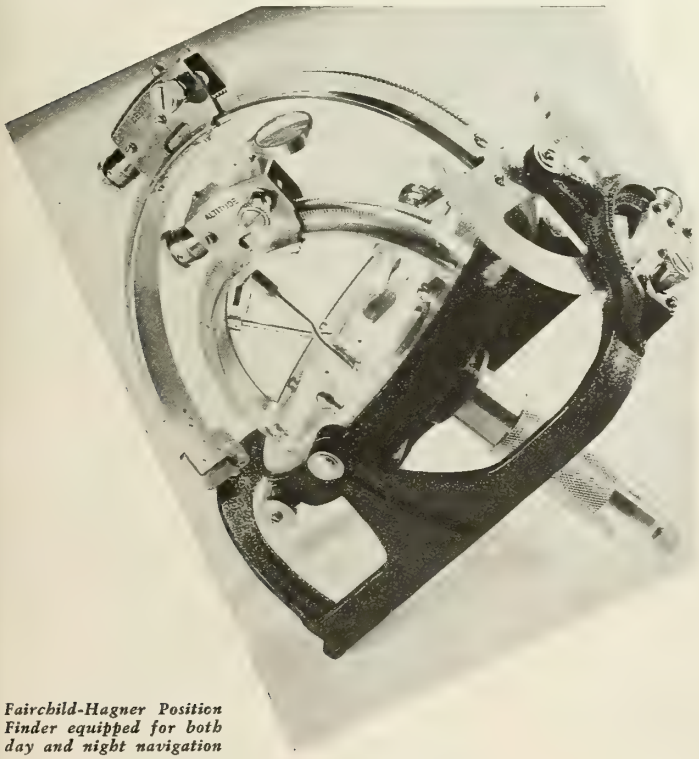
With the sextant device and a watch the altitude and time of observation of the celestial body is taken *and noted.* The celestial longitude (G.H.A.) of the observed body and the terrestrial longitude of the observer are mathematically combined. The result is termed the Local Hour Angle and represents the angular relation of the meridian of the observer and the meridian of the celestial body. The setting of this value is made on its individual protractor marked "L.H.A."

Then the angular relationship of the celestial latitude (declination) of the body (taken out of the Nautical Almanac) and the terrestrial latitude of the observer are mechanically compared by setting these values on the meridian arc and the latitude protractor respectively.

By releasing and swinging the azimuth plate on which the altitude arc is mounted, the altitude telescope is brought into the closest possible relation with the declination telescope.

In the majority of cases the two circles will not be concentric, indicating a difference between the assumed position and the position by observation. The alignment is completed by adjustment of the altitude telescope and the azimuth protractor only. The new altitude reading of the altitude rider is called the *computed altitude* and is the one that would have been observed if the assumed position was the observer's true position.

The value of azimuth or bearing of the observed celestial body from the assumed position of the observer is read directly from the azimuth plate of the instrument.



*Fairchild-Hagner Position Finder equipped for both day and night navigation*

**Hagner Method From D. R. Position**

GCT = 19h — 31m — 25s

| | | |
|---|---|---|
| 18h | = | 89° — 22′ — 36″ |
| 1h — 31m | = | 22° — 45′ — 00″ |
| 25s | = | 06′ — 18″ |
| GHA | = | 112° — 13′ — 54″ W |
| Long. | = | 73° — 54′ — 00″ W (D.R.) |
| LHA | = | 38° — 19′ — 54″ |

Set Dec. — 23° — 25′ N
Set Lat. — 40° — 45′ N (D.R.)
Set LHA — 38° — 19′ 54″ (D.R.)
Align declination and altitude telescopes by moving altitude and azimuth verniers.
Read Computed altitude 53° — 34′
Observed altitude 53° — 35′
Intercept 01′ Toward
Read Azimuth — N — 106° W
Plot position (D.R.) — Lat. 40° — 45′ N — Long. 73° — 54′ W
Plot azimuth N 106° — W through the D. R. position and 1′ toward the sun; plot the position line
Azimuth — N 109° 0 W (by compass)
Azimuth — N 106° W (true)
3° — compass error East

**Great Circle Course and Distance (by Hagner)**

Point 1—
Lat. 40° — 28′ N; Long 73° — 59′ W
Point 2—
Lat. 18° — 29′ N; Long 66° — 08′ W
Long difference 7° — 51′

1 — Set Lat.[1] — 18° — 29′ N on declination arc
2 — Set Lat.[1] — 40° — 28′ N on latitude arc
3 — Set longitude difference 7° — 51′ on LHA arc
4 — Align declination and altitude arcs by moving the altitude and azimuth verniers
5 — Read altitude 66° — 59′
90° — 00
23° — 01′
× 60′
1380′
+ 1′
1381′ nautical miles
Read azimuth 161° + = Initial Course

Note: There are only two mathematical functions by this method: (1) subtraction of computed altitude from 90°; (2) conversion of arc remainder to minutes in regular manner by multiplication. The course is supplied by inspection.

For long-range aircraft travelling at high speeds over the top of a total overcast, numerous determinations of position may save considerable fuel and time. Since the velocity and direction of the upper winds change according to location, with the present cruising speeds better than 200 mph, it may be necessary to change the drift angle correction every half hour in order to maintain the planned course. Frequent determinations of position facilitate the maintenance of the correct course and heading, and thus reduce flying time to a minimum.

# Barkley-Grow 8-Place All-Metal Transport



● Barkley-Grow Aircraft, Detroit, Mich., has completed its new T8P-1, an 8-place low-wing all-metal transport. The plane is an economical-operating high-speed machine designed either for feeder-line work or for private operation, and the first off the line has been sold to General Aviation Corp. of Denmark which is negotiating for licensing rights in that country.

Cantilever wing construction is used, the structure being multi-spar of special Barkley development, with a center section, outer panels and detachable tips. The wing consists essentially of a multiplicity of full-length 24S-T span-wise webs of suitably formed and lightened thin sheet to which the top and bottom coverings of Alclad 24S-T sheet are attached. There are no ribs or bulkheads.

Flaps are split and slotted, operated electrically. They extend from the inboard edge of the ailerons to a point where the wing fillets join the fuselage. In operation, the flaps operate so that slot action is used for the take-off and slotted and split action for landing.

Alclad 24S-T stressed skin of the fuselage has no fore and aft reinforcing members excepting a length of approximately 10 ft. in the region of maximum bending loads, where corrugated sheet is laid next to the skin and to which it is riveted. Construction is of the semi-monocoque type with 24S-T bulb and I section frames and bulb section stringers of the same material, the frames being cut out to allow the stringers to pass interrupted.

Arrangement of the cabin in the standard series provides for 6 passengers seated in 3 chairs on each side separated by an aisle, with two pilots forward. Optional arrangement provides for seven passengers in which case there is another seat aft at the starboard side of the cabin, and one pilot. Sound insulation is achieved by a combination installation of Seapak, felt and plastic materials.

Tail group also is full cantilever, of multi-spar construction similar to the wing. For higher aerodynamic efficiency, dual fins and rudders are provided.

Standard landing gear is the fixed type equipped with Goodyear low pressure tires, hydraulic brakes and *Aerol* shock absorbers. Metal streamlined fairings are provided on the wheels and over the leg of each unit. Tail wheel is full swivelling through 360° and is provided with a Goodyear tire on a Warner wheel.

Power is supplied by two Pratt & Whitney Wasp Junior SB engines rated 400 hp at 5000 ft. Hamilton Standard controllable-pitch propellers are standard equipment and tankage is provided for 120 gals. of fuel, or 160 gals. maximum, as well as 10 gals. of oil.

Standard equipment includes a 65 amp. Exide battery, Fafnir control bearings, Grimes navigation lights, Adams & Westlake landing lights, Kidde fire extinguisher and the following instruments: Kollsman altimeter, clock, engine gauge unit, airspeed and vertical speed indicators, compass, manifold pressure gauge; Pioneer turn and bank indicator; Weston thermocouple, ammeter, tachometers, cabin temperature and carburetor temperature gauges; Moto-Meter air temperature gauge, fuel gauge, and flap position indicator; Sperry directional gyro, gyro-horizon; and a Cambridge fuel-air ratio indicator.

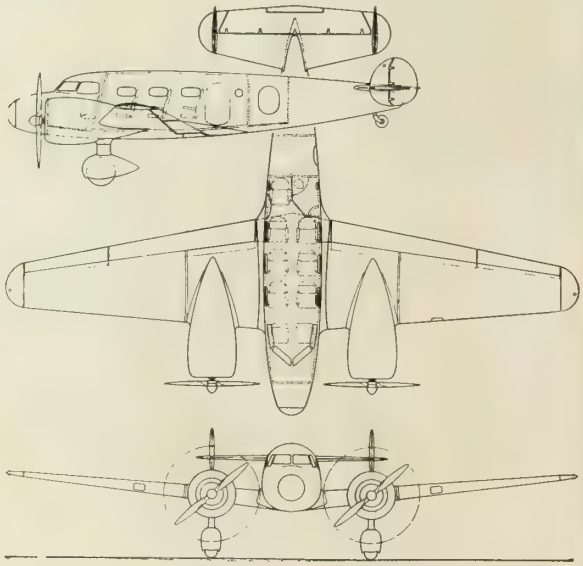
Specifications and performance figures (cruising performances at 75% power) of the P & W Wasp Junior powered Barkley-Grow T8P-1 follow:

| | |
|---|---|
| Wing span | 50 feet 8.75 inches |
| Overall length | 35 feet 8 inches |
| Overall height | 9 feet 7.5 inches |
| Wing area | 354 square feet |
| Power loading | 9.9 pounds/horsepower |
| Wing loading | 22.5 pounds/square ft. |
| Empty weight | 5365 pounds |
| Useful load | 2585 pounds |
| Payload | 1620 pounds |
| Gross weight | 7950 pounds |
| Maximum speed (sea level) | 213 mph |
| Maximum speed (5000 ft.) | 225 mph |
| Cruising speed (sea level) | 193 mph |
| Cruising speed (5000 ft.) | 204 mph |
| Landing speed | 64.6 mph |
| Rate of climb | 1420 feet per minute |
| Service ceiling | 24,000 feet |
| Cruising range (9600 ft.) | 470-630 miles |



*Barkley-Grow's low-wing 8-place transport*







A WORTHY OFFSPRING

OF THE FAMOUS "MISTER MULLIGAN"

# The New Howard DGA-8

IGNITION BY

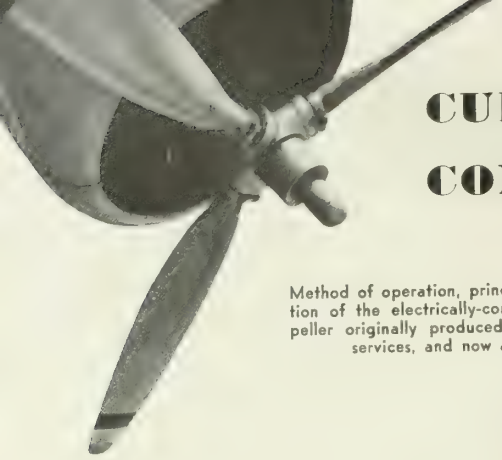
## SCINTILLA



BENNY HOWARD
Designer and Manufacturer

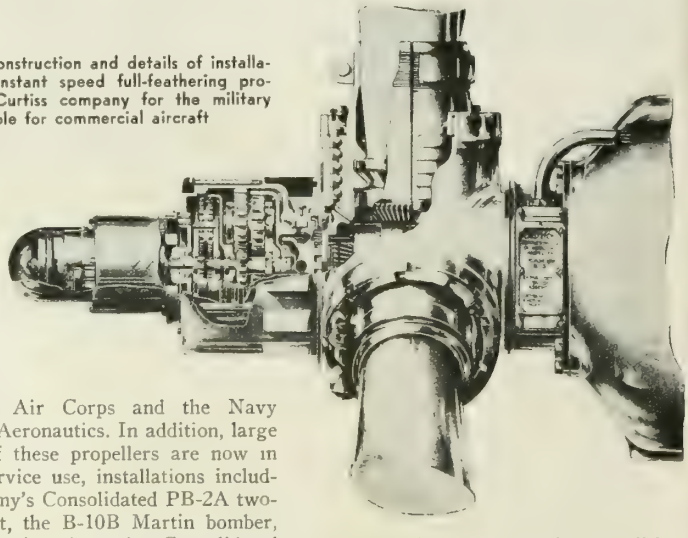
Benny Howard's achievements as a flyer and as a designer of aircraft rate and receive the admiration of all men who fly. It is a source of gratification to Scintilla that in the new Howard DGA-8, the universal trust of the industry in Scintilla ignition is once more evidenced.

SCINTILLA MAGNETO CO., Inc.
SIDNEY, NEW YORK
*(Subsidiary of Bendix Aviation Corporation)*



# CURTISS ELECTRIC CONSTANT SPEED PROPELLER

**Method of operation, principles of construction and details of installation of the electrically-controlled constant speed full-feathering propeller originally produced by the Curtiss company for the military services, and now also available for commercial aircraft**



● New demands have been imposed upon controllable pitch propeller equipment by trends in modern aircraft design toward multi-engine types supercharged for high altitude operation. Constant speed control is essential to secure the best operating conditions with a minimum of attention from the pilot and a wide operating range of blade angles is necessary to meet the requirements of increased speed range. To prevent possible further damage to the engine and airplane due to "windmilling" in the event of failure of one of the power plants, and to secure maximum performance from the remaining power, the propeller should be capable of attaining blade angles of 85° to 90° or of being "feathered." For maximum flexibility, the propeller control should be independent of the engine and the pilot should have ready means of selecting and controlling the type of operation desired at all times.

The Curtiss electric constant speed full feathering propeller has been produced to meet these requirements. Its development has been in process for a number of years, during which time more than 1000 hours of block testing have been accomplished, most of it in conjunction with the Army Air Corps and the Navy Bureau of Aeronautics. In addition, large numbers of these propellers are now in military service use, installations including the Army's Consolidated PB-2A two-seat pursuit, the B-10B Martin bomber, and the Navy's twin-engine Consolidated PBY-1 patrol boats. These have accumulated well above 35,000 hours of service use, and have demonstrated the reliability, safety and efficiency of this product.

Approved type certificates have been issued, and seven designs are now available for commercial use either with hollow steel or standard detachable type aluminum alloy blades.

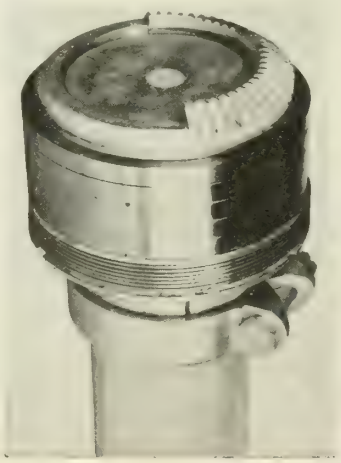
The electrical method of control has a flexibility which permits either constant speed or selective manual control in the same installation. Under selective manual control, any blade angle between the low pitch limit setting and the "feathered" angle may be obtained and maintained independent of engine condition. At any operating condition, propeller pitch may be fixed for magneto checking, mixture adjustment and performance checking. The hub construction and blade retention used impose no limitation on blade angle movements as great as 120°. Protection is afforded from extreme temperature, moisture and icing conditions by completely enclosing the pitch-actuating mechanism. in an aluminum housing. Provision also is made on the hub for mounting the conventional type de-icing spinner and slinger ring equipment.

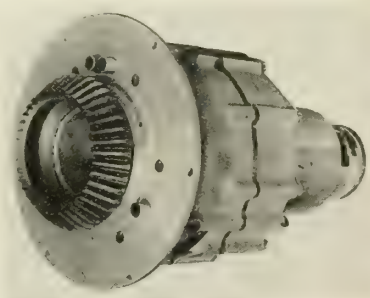
The hub is of the one-piece type, machined from a high strength alloy steel forging. On its rear extension is mounted

*(Continued on following page)*



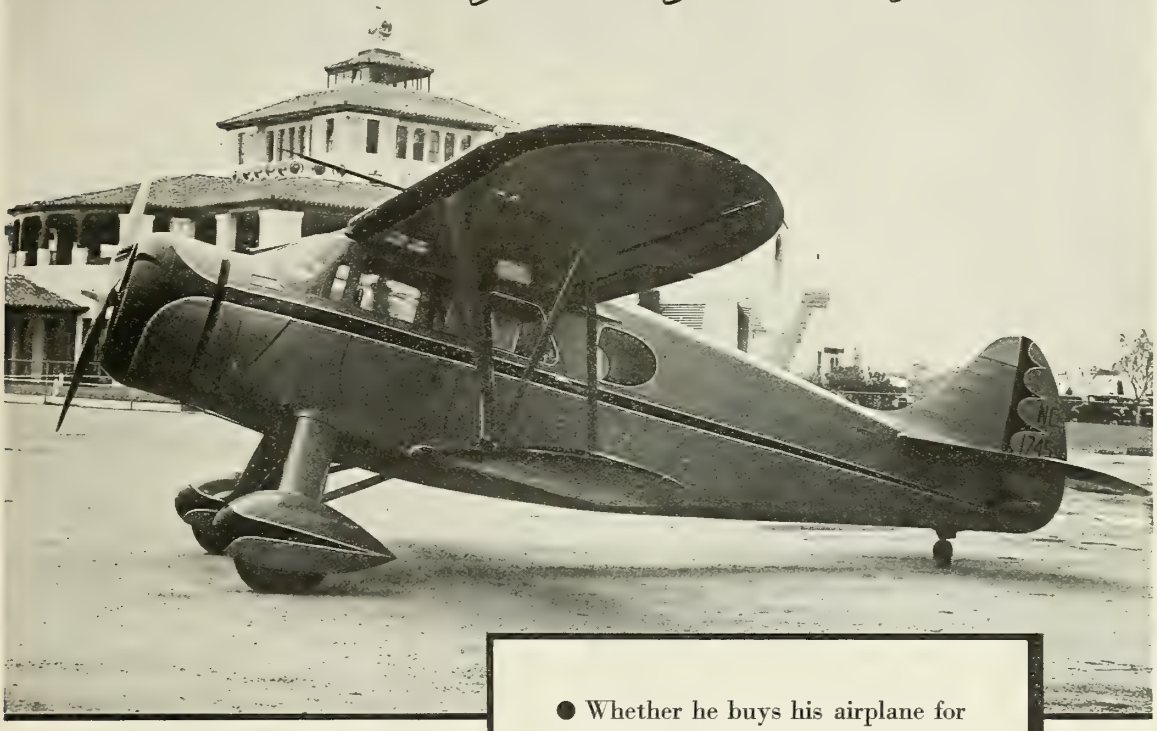
*The one-piece hub proper, a machined alloy steel forging. At the right is the blade end with its bearings and the gears which contact the electric motor's reduction gear*





*Electric power unit on the propeller hub which operates through a 2-stage planitary speed reduction to the bevel power gear which engages the gear shown at the left*

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*Waco Leads in Aircraft Registration*

WACO AIRPLANES

THE WACO AIRCRAFT COMPANY
TROY, OHIO

(*Continued from preceding page*)
the slip ring assembly which transmits electrical energy from the stationary brushes to fixed contacts at the front face of the hub. Suitable crankshaft nut, adapter and locking means are provided for ready installation on the standard propeller shaft.

The fixed brush assembly consists of a pair of spring-loaded carbon composition brushes for each slip ring, mounted in a block of insulating material and supported by a light alloy casting bolted to the thrust cover of the engine nose. This casting not only completely houses the electrical parts but also serves to seal and protect them. To insulate against shock and vibration the brush block is supported in its housing on special rubber bushings. Leading into the housing is a standard conduit fitting.

#### Blade-load Transmission

Centrifugal load of the blade is carried from a shoulder at the butt end, through a stack of angular contact bearings to the blade nut, where special buttressed threads transfer it to the hub barrel. The one bearing at the inner end is reversed for taking the "preload" when the blade nut is tightened to eliminate play from the bearing stack.

When hollow steel blades are used, bearings are mounted directly on the shank of the blade. For standard shank aluminum alloy blades, a split steel sleeve with standard clamp is provided for mounting the bearings and retaining the blade.

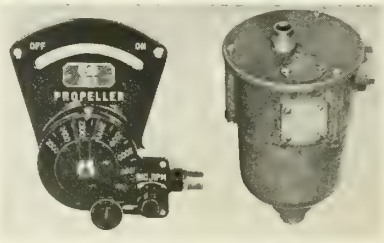
Pitch change is effected by a power unit consisting of a small reversible electric motor operating through a 2-stage planetary speed reduction unit to a bevel power gear which engages a bevel gear at the root of each blade. A spring-loaded no-voltage solenoid brake series connected with the motor is provided at the forward end of the electric motor to stop and prevent pitch change due to coasting, vibration or other cause when the motor fields are not energized.

Power unit assembly is located on the forward face of the hub by a pilot surface and is secured in place by 6 cap screws through the flanged face of the speed reducer housing. Four spring-loaded electrical contacts at the face of this flange match with the fixed contacts on the hub face to complete the electrical circuit from the slip rings to the motor.

Unit construction of the power unit, electric motor, speed reducer, slip ring and brush assembly not only facilitates inter-change of parts between propellers but also replacement of parts with minimum loss in operating time.

Normal pitch range of the blades is controlled by electrical limit switches operated by a cam on the shaft with the power bevel gear. This range is usually made to cover full requirements of normal flight, from take-off to maximum gliding descent speed. The number of teeth on the power gear and the number of splines on the power gear drive shaft differ, so that by a simple process of indexing, the range of the limit switches may be readily shifted to properly accommodate the take-off rating of various engines. Blade angles outside the normal flight range (such as feathering) are obtained by the manual control switch which bi-passes the cut-out limit switch.

The constant speed control consists of a conventional flyweight type governor driven at approximately engine speed. The flyweight force is balanced against a spring, the initial compression of which may be adjusted by the pilot in selecting the desired engine speed. While the speed is balanced, the pitch changing circuits are open and no change takes place. When the speed is above or below that desired, the flyweights (through a plunger) actuate a switch to close the increase or decrease pitch circuit and effect the necessary correction. The governor is adaptable to either mechanical or remote electrical control.



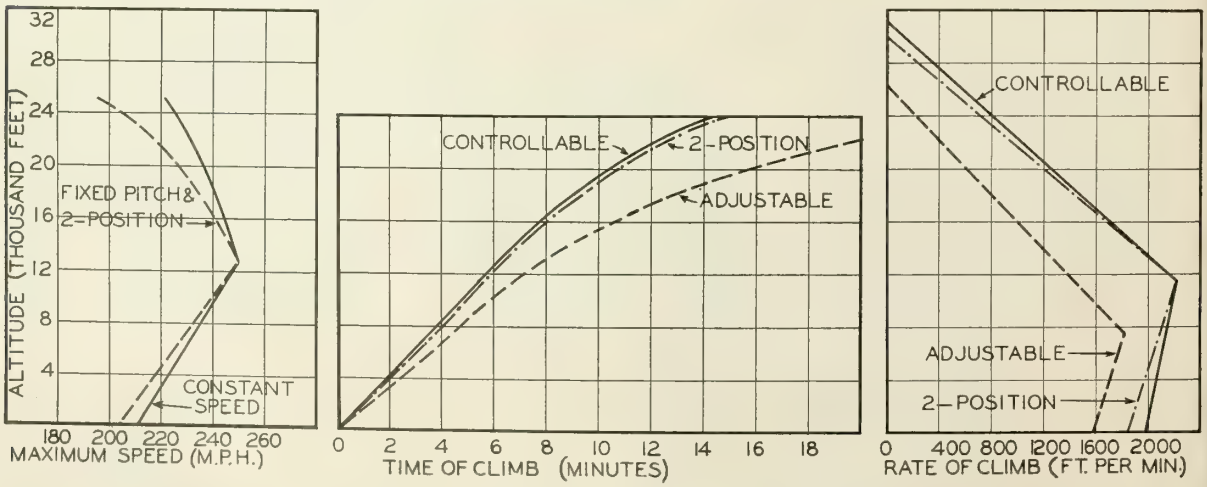

*The operating control in the cockpit, and the constant speed propeller governor, designed to maintain engine speed within 3 to 5 rpm*

#### Improved Performance

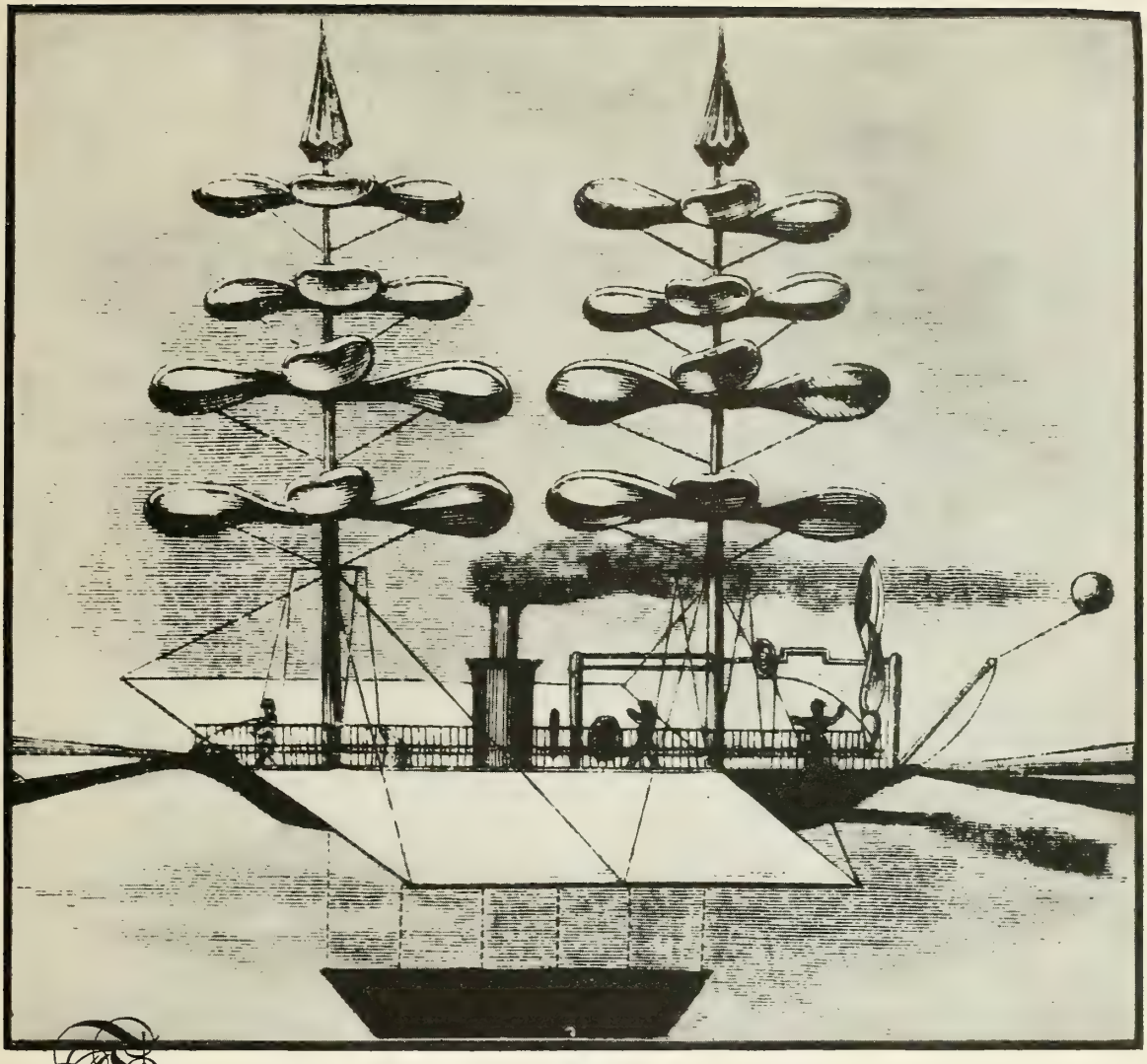
As an illustration of performance possible with the full feathering propeller, in a high-speed, high altitude four-engined transport plane equipped with 1000 hp power plants, a comparison of speeds attainable with one of the engines cut out shows that it is entirely practical to schedule operations with partial power plants.

Using four engines for the take-off (with the propellers set at an angle of 20°) climb at sea level is made at 147 mph, the blade angle being increased to 23.9°; at 10,000 ft. at 164 mph with blade angles at 27°. Cruising at 10,000 ft. on 700 hp of each of the four engines is 266 mph with blades set at 36.4°; with blades set at 35°, cruising speed on 3 engines (700 hp each) is 242 mph, while with blade angles of 32.7°, the plane could attain a maximum speed of 238 mph on two engines giving their power at 25,000 ft.

These figures indicate considerable saving in fuel consumption and increased cruising radius. Performance figures given would not compete in a "wind-milling" or braked propeller installation, since drag would be considerably increased.




*Advantages of the constant speed propeller as shown by performance curves of typical military airplane*



# The father of "Aviation" had to design for steam

GABRIELLE DE LA LANDELLE frowned. Flying should be on a scientific basis. The Vicomte de Ponton d'Amecourt and Felix Tournachon agreed. Had he not designed the "Steam Air Liner" the year before? Now, in 1864, the three had formed a society for further study. What should it be named? Slowly his pen traced "Societe de—AVIATION." The infant science was christened for all time.

His "Steam Air Liner," pictured above, startled the world. Octuple air screws provided lifting power. Large planes on either side were to maintain equilibrium. Parachutes atop each mast were to open when needed. Everything had been remembered. Everything but one. That had not yet been discovered—GASOLINE!

A practical power-weight ratio could not be established with a steam engine. So Landelle's design became another quaint picture in aviation's history.

Today, progress in aviation still depends on the inseparably linked fuel and engine. Constantly better gasolines open the way to better design. Even while Ethyl in aviation gasolines keeps pace and faith with present engines, Ethyl engineers are cooperating in research to bring the planes of tomorrow nearer. Ethyl Gasoline Corporation, Chrysler Building, New York, N. Y.

# Theoretical Determination of Air Forces and Moments on Wings

## PART II

***WILLIAM H. MILLER and PEYTON M. MAGRUDER***

***In the following article the authors continue reviewing the applications of classical aerodynamic theory to the determination of air loads on wings, which was begun in the January issue of* AERO DIGEST. *A knowledge of the spanwise lift distribution is of primary importance in airplane structural design, particularly in the case of the cantilever monoplane. The authors have therefore developed herein the analytical basis for such calculations in continuation of their discussion of the fundamental concepts of Dr. Munk and others. Practical examples of the use of the principal formulas developed in the present article will be presented in a later issue, together with applications to the biplane.***

● Calculation of the angles of attack (along the wing span) necessary to produce a given lift distribution is relatively easy by using the following formula [1] given in the January 1937 issue of AERO DIGEST:

$$\sum A_n \sin n\theta \ (1 + \mu n/\sin\theta) = \mu\alpha \ldots\ldots\ldots\ldots (1)$$

In this case, the values of the coefficients $A_n$ are known, or can be quickly determined, by the ordinary methods of harmonic analysis [2]. Conversely, the determination of the lift distribution when the geometrical angle of attack distribution is given, constitutes a more difficult and tedious problem. Nevertheless, since it is the latter case with which we are usually concerned in practice, this article will describe a method of carrying out the latter analysis.

Following Munk [3] and Lotz [4], (1) can be further generalized by expressing $(\alpha \sin\theta)$ and $(\sin\theta/\mu)$ in the following forms

$$\alpha \sin\theta = \sum_{m=1}^{m=\infty} B_m \sin m\theta \ldots\ldots\ldots\ldots (2)$$

$$\sin\theta/\mu = \sum_{k=0}^{k=\infty} C_k \cos k\theta \ldots\ldots\ldots\ldots (3)$$

For clarity, $B_m$ and $C_k$ will be referred to, respectively, as "angle" and "chord" coefficients. Formula (1) now takes the form:

$$\sum_{m=1}^{m=\infty} B_m \sin m\theta = \sum_{n=1}^{n=\infty} n A_n \sin n\theta + \sum_{n=1}^{n=\infty}\sum_{k=0}^{k=\infty} A_n C_k \sin n\theta \cos k\theta \ldots\ldots (4)$$

(1) Wm. H. Miller and P. M. Magruder, *Theoretical Determination of Air Forces and Moments on Wings;* AERO DIGEST, January, 1937 (page 32).
(2) Lipka, *Graphical and Mechanical Computation.*
(3) Max M. Munk, *Fluid Dynamics for Aircraft Designers.*
(4) I. Lotz, *Berechnung der Auftriebsverteilung beliebiz geformter Flugel;* Z. F. M., 1931.

Before discussing the utility of (4) it should be noted that (2) and (3) are, each, Fourier series whose coefficients are given by the usual integral formulas

$$B_m = 2/\pi \int_0^\pi (\alpha \sin\theta) \sin m\theta \ d\theta \ldots\ldots\ldots\ldots (5)$$

$$C_k = 2/\pi \int_0^\pi (\sin\theta/\mu) \cos k\theta \ d\theta \ldots\ldots\ldots\ldots (6)$$

$$C_0 = 1/\pi \int_0^\pi (\sin\theta/\mu) \ d\theta \ldots\ldots\ldots\ldots (6a)$$

It should be noted, also, that if the geometrical angle of attack is the same at points equidistant on each side of the plane of symmetry (i.e., if $\alpha \sin\theta = \alpha \sin [\pi - \theta]$), then the values of $B_m$ for even values of $m$ will be zero and the Fourier series for $(\alpha \sin\theta)$ will be

$$\alpha \sin\theta = B_1 \sin\theta + B_3 \sin\theta + B_5 \sin\theta + \cdots$$

If the geometrical angles of attack are equal in absolute value and opposite in sign, at equidistant points on each side of the plane of symmetry, then the values of $B_m$ corresponding to odd values of $m$ are zero and the Fourier series for $(\alpha \sin\theta)$ is

$$\alpha \sin\theta = B_2 \sin 2\theta + B_4 \sin 4\theta + B_6 \sin 6\theta + \cdots$$

Ordinary wings have a plane of symmetry, therefore only even terms will appear in the Fourier series for $(\sin\theta/\mu)$.

Since the left-hand side of (4) is a Fourier series, any "angle" coefficient is given by Fourier's integral formula

$$B_m = \frac{2}{\pi} \int_0^\pi f(\theta) \sin m\theta \ d\theta$$

where $f(\theta)$ is merely the right-hand side of (4). Therefore the "angle" coefficient, in terms of $A$ and $C$ coefficients is given by

(*Continued on page 75*)

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# Lockheed 14 Transport



## A New Fourteen-place Monoplane Transport of the Mid-wing Type

● Lockheed's largest project to date, an all-metal mid-wing transport for eleven passengers and a crew of three is scheduled to make its initial flight tests at Burbank, California in the near future.

The new model, known as the Lockheed 14, is constructed principally of Alclad 24S-T around a monocoque fuselage and single-spar, skin-stressed wing, following Lockheed practice. Liberal use is also made of duralumin forgings and Alclad 24S-RT. The twin rudder and fin arrangement, familiarly associated with the Lockheed Electra and Lockheed 12, also is retained in this new design.

Innovations include commercial adoption of integral fuel tanks (now used on several military planes) and utilization of all-metal Lockheed-Fowler wing flaps, electrically-operated. Use of the integral fuel tanks eliminates excessive weight and decreases chances of fuel tank difficulties inasmuch as the walls of the wing form the upper and lower surfaces of the tank. The new-type flaps offer twice as much lift as standard flaps and can be used at the take-off as well as for landing. Take-off run with these flaps is 18% less than ordinarily required.

Sufficient room has been provided in the cabin to assure comfort for passengers. The head-room is 6'-3" and a wide aisle separates two rows of seats. Other cabin measurements are—maximum width 65.5" and length 19'. Passenger chairs are deeply upholstered, have adjustable reclining backs, and are rotatable. Each seat is adjacent to a window, individual reading light, ash tray, call button and an air duct. Further attention to passenger comfort is evidenced in soundproofing, thermostatically-controlled heating system, and a fully-equipped, heated and ventilated lavatory. The conventional overhead rack for wraps and small packages is provided.

The wing is built in three sections—a center section and two outer panels. The center section is cut away at the fuselage permitting it to be placed partly within the wing, thus providing small frontal area. The airfoil section is the latest NACA type similar to that used in the Lockheed 12.

Baggage compartments are close to the center of gravity giving a centralized distribution of load, improved flying qualities and elimination of use of ladders and loading wagons. About 64 cu. ft. of baggage space is available in the front and rear lower compartments, and 124 cu. ft. in the front and rear nose compartments, giving a total of 190 cu. ft. for cargo.

The tail group is all-metal with two non-adjustable fins and two dynamically balanced rudders provided with controllable tabs. The stabilizer is non-adjustable and the elevator is statically and dynamically balanced as well as equipped with a pair of tabs.

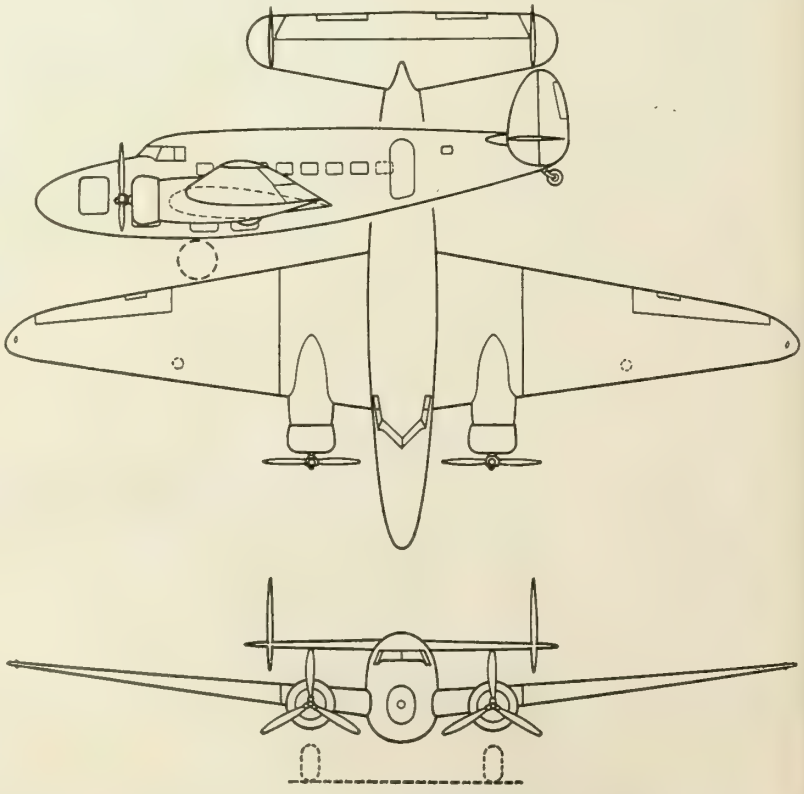
Retraction of the landing gear is by electrical means with a hand mechanism as auxiliary equipment. Goodyear wheels and tires, pneumatic shock struts, hydraulic brakes and a parking brake system are provided.

Low-drag, bell-shaped NACA engine cowlings enclose the two Wright Cyclone GR-1820G-3 engines, each of which provides 840 hp at 2100 rpm up to 8700 ft. for maximum continuous operation. Each engine is equipped with a Hamilton Standard metal constant speed propeller, pressure type cylinder cooling baffles, and stainless steel exhaust collector ring. Mounting is in rubber on Lord units.

The plane is expected to attain a maximum speed of 265 mph and a cruising speed of 240 mph. Take off time is 11 sec., after a run of 610 ft. With full load the transport will climb to an absolute ceiling of about 28,000 feet. and will operate, with one engine, at 14,000 ft.

Specifications and estimated performance data on the Lockheed with 840 hp Wright Cyclone GR-1820G-3 engines are as follows:

| | English | Metric |
|---|---|---|
| Wing span | 65'6" | 19.95 m |
| Length | 44'2.5" | 13.40 m |
| Height | 11'5.5" | 3.49 m |
| Wing area | 551 ft² | 51.20 m² |
| Power loading | 8.93 lbs./hp. | 4.05 kg./hp |
| Wing loading | 27.2 lbs./ft² | 132.5 kg./m² |
| Empty weight | 9685 lbs. | 4390 kg |
| Useful load | 5315 lbs. | 2412 kg |
| Gross weight | 15,000 lbs. | 6802 kg |
| Baggage allowance | 340 lbs. | 154 kg |
| Fuel | 460 gals. | 1740 lit |
| Oil | 29 gals. | 110 lit |
| Maximum speed | 265 mph | 426 kph |
| Cruising speed | 240 mph | 386 kph |
| Landing speed | 65 mph | 105 kph |
| Service ceiling | 26,300 ft. | 8020 m |
| Climb per minute | 1700 ft. | 518 m |
| Cruising range | 1000 mi. | 1608 km |



*Outlines of the new fourteen-place Lockheed 14 transport*

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# Inevitable Inventions in Aircraft Radio

***HENRY W. ROBERTS***
Radio Editor

● There are certain demonstrated needs in aircraft navigation which invite solution through the medium of radio. Far from being in the wish-fulfilment class, the devices suggested to meet these needs are logical in conception, and feasible technically, *with the knowledge now available.* They are the inevitable inventions in aircraft radio.

#### Absolute Altimeter

Probably the most urgently needed invention is the absolute altimeter, indicating the actual altitude of an airplane above the terrain below, rather than its altitude above sea level.

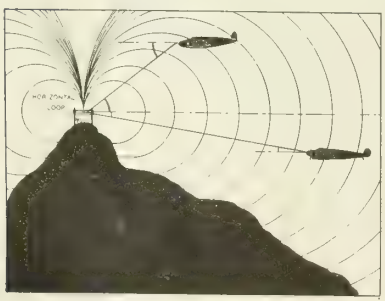
Two methods of absolute altitude indication are theoretically possible—sonic and electric, the latter offering two possibilities: interpreting capacity potential between aircraft and ground; and interpreting radio waves transmitted by the aircraft and reflected by the ground. These methods were successfully applied to depth sounding in marine work, but their application to aircraft presents interesting problems.

The sonic method may be discarded as inexact. The speed of propagation of sound through the air is greatly affected by temperature and humidity, and the ground itself is not a uniform sounding board.

Likewise, in dealing with capacity potential between aircraft and ground, too many variable factors beyond the inventor's control make the operation of even the most carefully constructed apparatus uncertain. The dielectric constant of the air varies with weather; the ground potential is also affected by weather, as well as by its mineral content; and the potential of the airplane is affected by atmospheric electricity.

The logical approach lies in reflected radio waves. Here the factors beyond the inventor's control—the electronic vagaries of the air and ground—do not affect the propagation of radio waves to the same critical degree as in the case of capacity potential measurements, and recent studies in controlled radiation patterns give definite indication that such an instrument is feasible.

On the basis of available knowledge, it is reasonable to expect the invention of a reliable and reasonably accurate absolute radio altimeter, probably employing reflected ultra-high frequency wave, and possibly giving continuous and automatic absolute altitude indication through the use of a cathode ray tube arrangement, marked in feet for direct reading.



*Horizontal loop marker beacons could be used to indicate relative elevation*

#### Radio-controlled Gyropilot

Successful radio-controlled flights have been made in half a dozen countries, but the devices apparently remain secret, although their military value is to be doubted; the construction of such a device presents no serious difficulties as indicated by dozens of radio-controlled boats constructed by radio amateurs.

It is known that airplanes have been sent aloft without a pilot, maneuvered about an airport, and landed again, controlled solely by radio worked by a ground operator who must constantly see the ship. It is conceivable that, in the event of war, a fleet of radio-controlled bombers, or even flying torpedos, could be dispatched to a distant invisible point with reasonable accuracy. However, it is inconceivable that the enemy would not have sense enough to blanket the operating frequencies by strong radio interference from his own stations, thereby rendering the armada uncontrollable.

It is greatly to be feared that the military value of radio and radio-controlled devices is negligible. Attainments in aircraft radio are probably destined to be mainly peaceful.

In commercial operation, it is theoretically possible to navigate an airplane by radio, from take-off to landing, by any of the three methods of radio navigation: radio range beacons, airplane direction finders, or ground direction finders; and to bring the ship to its destination without collision with ground obstructions or other aircraft aloft. Airway traffic as yet does not warrant such extensive mechanization of navigational procedure; nevertheless, automatic radio navigation of aircraft must come, at least on crowded trunk airways.

The immediate need of a radio-controlled automatic pilot is in the instrument landing procedure. The instrument landing system eventually to be adopted will probably be a modification of the original Bureau of Standards system, such as UAL-Bendix (AERO DIGEST, Oct. 1936) or W.I.T. Air-Track (AERO DIGEST, Apr. 1937). Navigating a transport down the rapidly narrowing spatial landing path requires a high degree of personal skill. The automatic pilot, possessing a quicker response to outside stimuli than the human machine, has already been successfully applied to instrument landings. The next logical step is the development of a totally automatic radio-controlled instrument landing procedure for aircraft.

#### Short-wave 360° D-F

To date the principal accomplishment in aircraft direction finder research was the clarification of just what is needed in such an instrument. To be of practical value, at least in scheduled operations, and become a permanent integral part of radio navigational procedure, it must be capable of continuous and automatic indication in degrees of arc. Not less than three such D-Fs are, or will soon be, available on the American market, two of them capable of indication throughout the compass.

It can be predicted that radio navigation solely by aircraft D-Fs will never become a reality. Some sort of radio traffic control from the ground is imperative, automatically relegating aircraft D-Fs to auxiliary use. They can, however, be made extremely useful, and will undoubtedly have a place in future radio navigational procedure.

The development of these instruments so far has been towards universality, rather than specialization. Using substantially the same super-heterodyne circuit, they attempt to give indication on long, broadcast and short waves, with the result that the apparatus is complex, expensive, and not uniformly accurate throughout the band spread. Below 100 metres, directional indication is not attempted.

Direction finding with short and ultra-short waves, with a range of a few miles, will probably play a major part in tomorrow's navigational procedure. We can foresee the development of a simple and inexpensive short-wave short-range aircraft D-F, capable of continuous and automatic indication, in degrees, throughout the compass, operating probably on only one frequency, or over a small frequency spread with one or two crystal-controlled frequencies. This D-F would be used principally to indicate the position of aircraft with respect to radio marker beacons, and could be made to

(*Continued on following page*)

# The STEARMAN "PT-13"

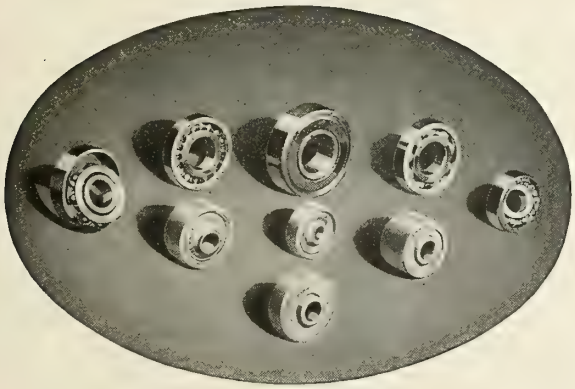
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The "primary training airplane" here shown is one of a fleet of 98 being built for the U. S. Army Air Corps by the Stearman Aircraft Company of Wichita, Kansas. NORMA-HOFFMANN PRECISION BEARINGS are employed in numerous places throughout the controls. The Pioneer turn-and-bank indicator and Sperry instruments employed, are also NORMA-HOFFMANN equipped.

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NORMA-HOFFMANN BEARINGS CORPORATION, STAMFORD, CONN., U. S. A.

PRECISION BALL, ROLLER, AND THRUST BEARINGS

(*Continued from preceding page*)
actuate the automatic pilot to guide the aircraft past obstructions.

#### Radio Drift Indicator

With an aircraft radio direction finder capable of bearing indication in degrees, it is possible to fly a Great Circle course corrected for drift by observing divergence between the radio course and the directional gyro course, and applying rudder correction until no further divergence occurs.

In actual practice this procedure occupies too much attention, and the accuracy of observations rapidly decreases with increased distance from the radio transmitting station. Nevertheless, flying a course at the correct drift angle is important in instrument navigation—not because of the longer air distance otherwise travelled (the elapsed time is virtually the same), but because of the possibility of encountering unexpected obstacles off the airway.

A "blind" flying drift indicator is already needed, and with increases in scheduled traffic under adverse visibility conditions this need will soon become pressing.

The inevitable development of such a radio drift indicator for instrument flying is a problem in coordination of radio and gyroscopic data, and will undoubtedly tax the ingenuity of more than one inventor.

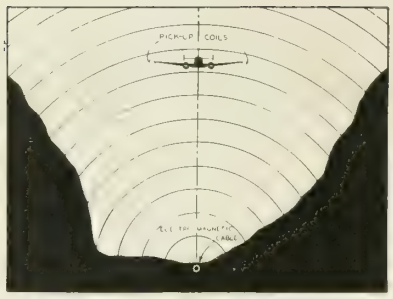
#### New Marker Beacons

Logical analysis of aircraft radio navigation problems leads to the conclusion that radio marker beacons will be extensively used in the near future. Definite orientation of aircraft with respect to ground always has been a weak link in the radio navigational chain. Definite position check is now possible only at the cone of silence of radio range beacon stations, and at barely two score radio marker beacons scattered across the continent.

Considerable development and research on radio marker beacons is now in progress. Of particular interest is better control of radiation patterns and the use of ultra-high frequencies, resulting in a stable and clearly defined short-range marker field.

Omitting specialized types (such as used in instrument landing systems) radio marker beacons fall into three broad classes—course markers, obstruction markers, and collision warning devices. It is logical to assume that in the future, in the interests of safety, all marker beacons will operate on only one frequency; and that, because of propagation characteristics, an ultra-high frequency will be selected, possibly 75,000 kc.

The present infrequent course marker




*An electromagnetic cable could be used in difficult locations to guide planes*

beacons operate in the long-wave range frequencies, and radiate non-directionally their identifying code signals which are heard superimposed on the range course signal. The few obstruction radio markers, serving to indicate locations of high radio towers in the vicinity of airports, are also heard superimposed on the range course signal. With the simultaneous transmission of weather forecasts (*also* superimposed on the course signal) it is sometimes confusing to follow a course. Considerable clearing up of this radio traffic is definitely indicated.

With the development of the suggested short-wave short-range 360° aircraft D-F operating on a single frequency, the pilot would be afforded automatic and continuous independent visual indication of the position of *all* marker beacons with respect to his airplane. In certain locations the functioning of radio ranges is not reliable; neither are the conventional methods of long-range direction finding (Aero Digest, Feb. 1937). In almost all such locations, a chain of short-wave short-range markers, used in conjunction with the suggested D-F, would correct the situation and guide aircraft along the established airway.

Several approaches to the problem of development of collision warning devices are possible. The growing density of air traffic will soon make such devices necessary. It may be conjectured that they will take form of non-directional radiations transmitted by aircraft in flight, received and interpreted directionally aboard other aircraft in the immediate vicinity. It is probable that the directional indication will be made available in zenith as well as in azimuth, to indicate relative elevation of the marker as well as its direction.

The development of reliable zenithal indication in degrees of arc would probably lead to the abandonment of the present curved path of constant field intensity used for glide path demarcation in instrument landing systems, and its replacement by the inclined straight-line glide path thus made possible.

#### Electromagnetic Cable

The once-ridiculed idea of navigating aircraft over an electromagnetic cable laid on or in the ground may be revived. The reason lies in the fact that electromagnetic phenomena are far more stable than electrostatic phenomena, and in geographical locations with extremely bad electrical properties (of which, fortunately, there are but a few on this continent) it may be the best means of safely guiding aircraft over an electrically difficult terrain.

A similar idea was successfully applied in the New York harbor during the War, guiding vessels through mine fields. The installation consisted of an electromagnetic cable laid along the free channel, grounded at one end through a resistor. An oscillating current was fed to the cable, setting up electromagnetic lines of force encircling the cable, which were received aboard the vessel by two pick-up coils located on either side of the hull. The vessel's position with respect to the cable was then indicated by the relative signal intensity in the two coils.

Substantially the same system could conceivably be applied to aircraft. True, the cost of such an installation, of the attendant development work, and above all, its operation and maintenance, would be well-nigh staggering. However, the costs of airplane accidents are also becoming staggering as the airplanes grow in size, and the project may yet be economically justified.

That final note of economic justification is the keynote to the forthcoming inventions in aircraft radio.

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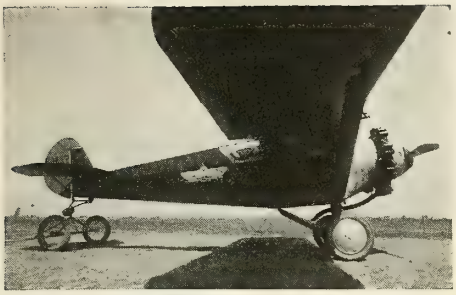
## HUMAN ELEMENT

(*Continued from page* 35)
abandon. Some leading psychologists claim that the average American possesses a fundamental trait of cheerful recklessness; he is disposed to take chances, not always with harmful intent, and the philosophy of "trying anything once" is allowed to grow in his mind from childhood. With maturity it is predominant in our soldiers, as evidenced by their courage and lightheartedness.

However, the presence of refractoriness is also an asset to the pilot, in that to a great extent it relieves conscious inhibitory effort. It facilitates repression of phobia, trauma, and innate instincts such as self-preservation, fear of falling, etc., thereby helping the pilot to adjust himself to his three-dimensional environment.

Due latitude must be given in the discussion of this condition in the pilot's make-up. The majority of pilots who are reckless in their behavior, in the air and on the ground, are not usually braggarts or excitable chance-takers. In this profession, as in all others, we occasionally encounter some who with no harmful intention, and even with a certain amount of caution, will "play." However, to the fellow who does not possess a level head

(*Continued on page* 96)



*1924 . . . Ryan M-1*



*1927 . . . "Spirit of St. Louis"*

# Then and Now—RYAN Leads

**1924**—Ryan M-1, designed and manufactured by T. Claude Ryan, was America's first popular high wing monoplane. It was standard equipment with three of the country's original air mail carriers.

**1927**—Col. Chas. A. Lindbergh's "Spirit of St. Louis," a development of the M-1, established a record of performance unsurpassed.

**1937**—After 13 years of development the Ryan S-T is America's most modern, high performance sport and training plane. Designed and manufactured under the direction of T. Claude Ryan, the Ryan S-T is first to feature in a medium size ship the all metal, monocoque fuselage, wing flaps and trimming tabs as used on transports and military planes.

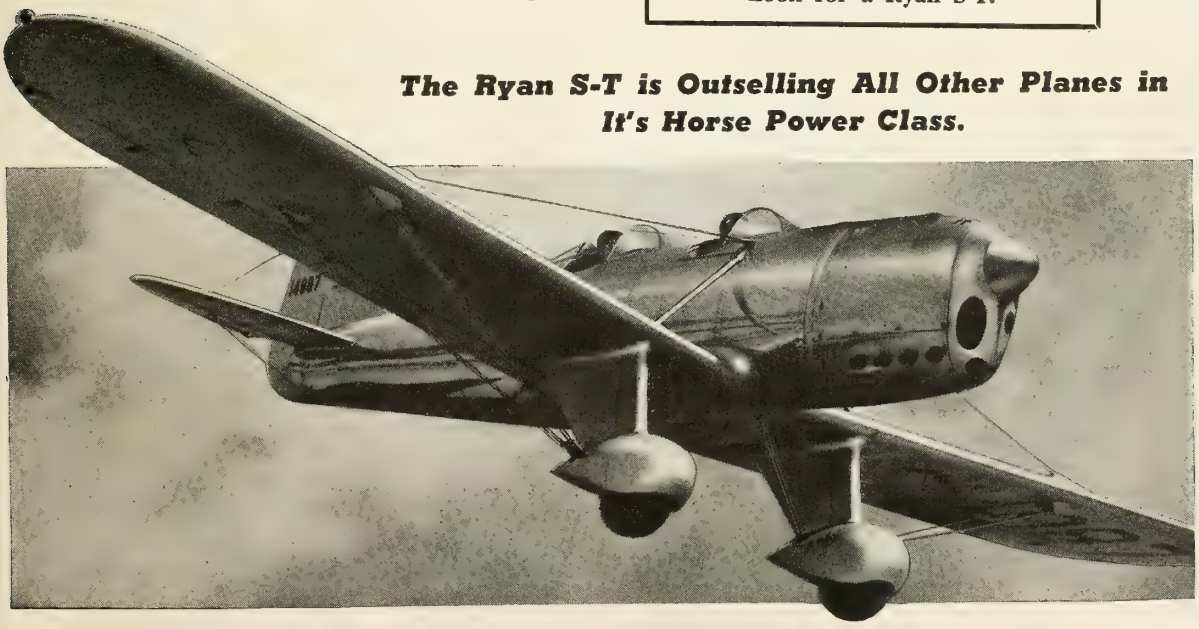
Speed, safety and economy are results of Ryan S-T design. Menasco in-line engine installations, ranging from 95 to 150 h.p., are available for any need from private owner to primary military trainer. Typical performance is the 127 m.p.h. cruising and 150 m.p.h. top speed of the 125 h.p. model. Yet with this high performance its perfect maneuverability, ease of control and 42 m.p.h. landing speed make it an ideal plane for either novice or professional pilot.

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# RECENT PATENTS

● The following recent patents of interest to readers of AERO DIGEST were compiled from the Official Gazette of the United States Patent Office:

Safety parachute attachment for airplanes. Thomas Lewis and Sidney J. Robinson, Mumford, N. Y. (2,072,600)

Propeller. Frank W. Caldwell, Hartford, Conn., assignor, by mesne assignments, to United Aircraft Corp. (Reissue 20,283)

Magnetic plug. Albert E. Bock, White Clay, Nebr., assignor to Lisle Corp., Clarinda, Iowa. (Reissue 20,291)

Radio system. Jozef Plebanski, Warsaw, Poland, assignor to Radio Patents Corp. (2,072,962)

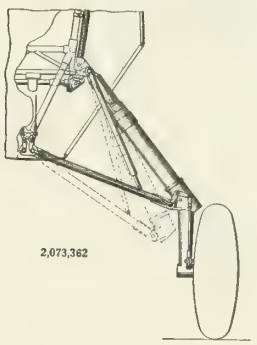
Means for locating engine dead-centers. Butler J. Haskins, Chicago, Ill., assignor to Joseph Weidenhoff, Inc. (2,072,984)

Hose clamp. Marcel Urbain Caillau, Boulogne-sur-Seine, France. (2,073,294)

Airplane. Frederick W. Peel, Bedford, Va., assignor to L.P.R. Company. (2,073,318)

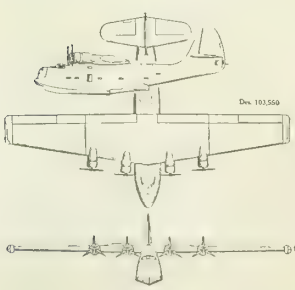
Wing truss. Robert R. Osborn, Kenmore, N. Y., assignor, by mesne assignments, to Curtiss-Wright Corp. (2,073,350)

Retractable landing gear. Ar-



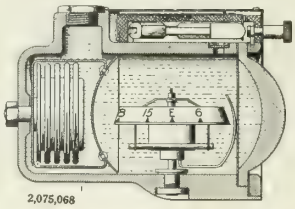

thur G. Butler, Eggertsville, and Richard E. Palmer and Samuel T. Payne, Kenmore, N. Y., assignors, by mesne assignments, to Curtiss-Wright Corporation. (2,073,362)

Design for a four-engined fly-



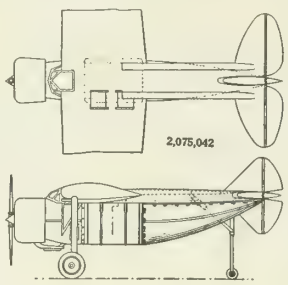
ing boat. Isaac M. Laddon, San Diego, Calif., assignor to Consolidated Aircraft Corporation. (Design 103,550)

Illuminating means for indicat-




ing instruments. Raymond K. Stout, Dayton, Ohio. (2,075,068)

Transport cargo aircraft. Hugh




J. Knerr, Langley Field, Va. (2,075,042)

Hydroplane vane. Herbert Luther Adams, Washington, D. C. (2,073,438)

Aircraft flotation system. Walter H. Freygang, Weehawken, N. J., assignor to Walter Kidde & Co., Inc. (2,073,688)

Aircraft. Alanson P. Brush, Detroit, Mich. (2,073,864)

Device for the mounting of engines. Eugene Prosper Renaux, Paris, and Lucien Jules Renaux, Livry-Gargan, France. (2,073,976)

Resilient wing mounting and framing. Herbert Luther Adams, Washington, D. C. (2,074,099)

Airfoil used in aeronautics. Louis Béchereau, Paris, France, assignor to Society Avions Kellner-Béchereau, (2,074,201)

Aircraft. Haviland H. Platt, New York, N. Y., assignor to Frederick W. Wilkening. (2,074,342 and 2,074,805)

Brake for airplanes. Overton M. Bounds, Oklahoma City, Okla. (2,074,360)

Airplane. Jakob Hojnowski, Nekoosa, Wis. (2,074,395)

Connection for flexible hose. Wilfred B. Pickard, Watertown, and James C. G. Maxwell, Waterbury, Conn., assignors to The American Brass Co. (2,074,425)

Rudder. Herbert Luther Adams, Washington, D. C. (2,074,765)

Means for silencing gaseous currents. Joseph Blanchard, London, England, assignor of one-half to Cecil Gordon Vokes. (2,075,088)

Level flight control for airplanes. Bert G. Carlson, Bellerose, N. Y., assignor to Sperry Gyroscope Co., Inc. (2,074,828)

Propeller. William J. Symons, Santa Monica, Calif., assignor to Helen W. Symons. (2,074,871)

Airplane. Walter W. Everts, Baltimore, Md., assignor to Everel Products Corp. (2,074,897)

Airplane control mechanism. Carl E. Jones, Douglas, Ariz. (2,074,914)

Bodily movable plane. Herbert Luther Adams, Washington, D. C. (2,074,766)

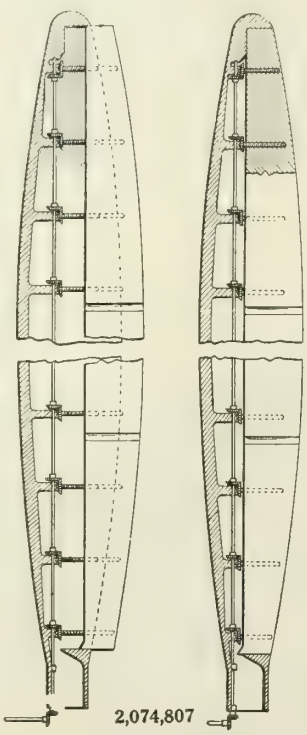
Machine provided with an automatic firearm. Marc Birkigt, Bois-Colombes, France. (2,075,086)

Airplane provided with an automatic firearm. Marc Birkigt, Bois-Colombes, France. (2,075,087)

Aluminum alloy. Walter Bonsack, Cleveland Heights, and John G. Frost, Cleveland, Ohio, assignors to The National Smelting Co. (2,075,089; 2,075,090; and 2,075,091)

Work support for riveting machines. Arthur R. Havener, Wayland, Mass., assignor to Judson L. Thomson Manufacturing Co. (2,075,113)

Adjustable area propeller blade.

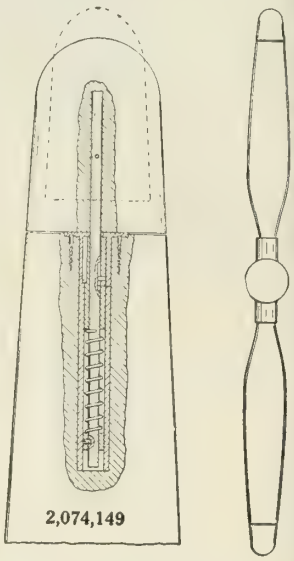



Elliott W. Reed, Cloquet, Minn. (2,074,807)

Beacon system. Forrest S. Mabry and Carl J. Madsen, Springfield, Mass., assignors to Westinghouse Electric & Manufacturing Co. (2,075,125)

Warning speed indicator. Francis Lohman, Detroit, Michigan. (2,075,530)

Propeller tip centrifugal pitch




control. Joseph H. Jacobs, Minneapolis, Minn. (2,074,149)

Engine starting mechanism. Raymond P. Lansing, Montclair, N. J., assignor to Eclipse Aviation Corp. (2,075,119)

Rivet setting device. Ross H. Begg, North Haledon, N. J., assignor to Breeze Corporations, Inc. (2,075,162)

Internal combustion engine. Emil Schimanek, Budapest, Hungary, assignor to Société du Carburateur Stratos. (2,075,231)

Silencer for internal combustion engines. Einar Olof Eugen Tydén, Stockholm, Sweden, assignor, by mesne assignments, to Carl Theodor Setterberg. (2,075,316)

Ice preventing device. John Edwin Ramsbottom, Benney Lockspeiser, and Charles John Stewart, Franborough, England. (2,075,658)

Apparatus for preventing ice accumulation on aircraft. John Edwin Ramsbottom, Benny Lockspeiser, and Charles John Stewart, Franborough, England. (2,075,569)

Article deposit and pick-up apparatus for airplanes Lytel S. Adams, Irwin, Pa., assignor of one-half to Arthur Patterson. (2,075,690)

Tiltable wing. Herbert Luther Adams, Washington, D. C. (2,075,787)

Wing broadening extension. Herbert Luther Adams, Washington, D. C. (2,075,788)

(*Continued on following page*)

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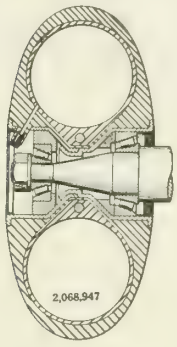
Multiple ignition switch. Edward B. Nowosielski, Bloomfield, N. J., assignor to Eclipse Aviation Corp. (2,069,676)

Rate of climb instrument. Adolf Urfer, New Rochelle, N. Y., assignor to Pioneer Instrument Co., Inc. (Reissue 20,263)

Fluid distribution system. Carroll R. Alden, Detroit, Mich., assignor to Ex-Cell-O Aircraft & Tool Corp. (2,069,744)

Mandrel for spinning metal. John Squires, Hagerstown, Md. (2,069,858)

Wheel (for airplane). Frederick

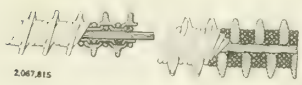



C. Frank, South Bend, Ind., assignor to Bendix Aviation Corp. (2,068,947)

Propeller. George C. Lembas, Chicago, Ill. (2,067,770)

Gauge for fluids in tanks. Michael Skuret and John Sekula, Clifton, N. Y. (2,067,795)

Power or movement transmit-




ting mechanism. William Edward Barber and Henry Archibald Watts, South Farnsborough, England. (2,067,815)

Exhaust silencer. Howard H. Couch, Oakwood, Dudley W. Watkins, Patterson Field, and James B. Brelsford, Dayton, Ohio. (2,069,751)

Practice bomb. Clarence F. Hofstetter, United States Army, Missoula, Mont. (2,069,759)

Shock absorber. John F. Wallace, Cleveland, Ohio, assignor to The Cleveland Pneumatic Tool Co. (2,069,791)

Internal combustion engine. Archie M. Niven, Detroit, Mich., assignor, by mesne assignments, to Continental Motors Corp. (2,069,843)

Mounting mechanism for rotative aircraft sustaining wings. Joseph S. Pecker, Philadelphia, and Agnew E. Larsen, Huntingdon Valley, Pa., assignors to Autogiro Company of America. (2,069,846)

Apparatus for installing tubular rivets. Harry E. Waner, Akron, Ohio, assignor to the B. F. Goodrich Co. (2,069,907)

Folding landing gear. Arthur G. Butler, Buffalo, N. Y., assignor, by mesne assignments, to Curtiss-Wright Corp. (2,069,994)

Releasing tank and bomb rack. Ralph D Carleton, Snyder, and Clem G. Trimbach, Eggertsville, N. Y., assignors to Curtiss-Wright Corp. (2,069,996)

Spring nut. Shesley Dom, Pleasant Ridge, and William J. Moeller, Mount Healthy, Ohio, assignors to The Philip Carey Manufacturing Co. (2,070,005)

Wing spoiler. Bruce G. Eaton, Jr., and Harry A. Sutton, Buffalo, N. Y., assignors, by mesne assignments, to Curtiss-Wright Corp. (2,070,006)

Aeroplane. James Martin, Higher Denham, near Uxbridge, England. (2,070,086)

Airplane navigating apparatus. Francis M. Pottenger, Jr., Monrovia, and James R. Balsley, La Canada, Calif.; said Balsley assignor of twelve and one-half percent to Paul Whittier and twelve and one-half percent to Keith Scott, Los Angeles, Calif. (2,070,178)

Automatic transmission. Romeo M. Nardone, East Orange, N. J., assignor to Eclipse Aviation Corporation. (2,070,215)

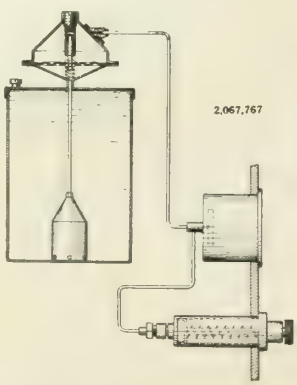
Facsimile transmission system. La Verne R. Philpott, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Co. (2,070,312)

Engine. John H. Geisse, Madison, Wis. (2,070,588)

Helicopter. George Francis Myers, New York, N. Y. (2,070,610)

Helicopter and rotating wing aircraft. Walton Victor D'Arcy Rutherford, England, and Raoul Hafner and Bruno Nagler, Vienna, Austria. (2,070,686)

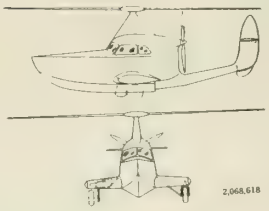
Hydrostatic gauge. Paul Kolls-




man, Woodhaven, N. Y. (2,067,767)

Airplane. Albert Schramm, Astoria, N. Y. (2,071,221)

Aircraft, and sea gyroplane.



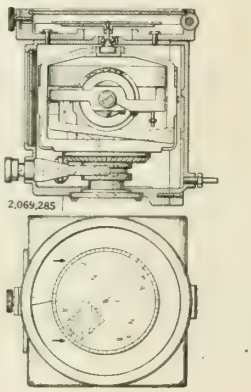

Edward Burke Wilford, Merion, Pa. (2,068,616 and 2,068,618)

Wireless direction finding system. Harry Melville Dowsett and Louis Edward Quintrell Walker, London, and Robert Cadzow, Argyllshire, England, assignors to Electric and Musical Industries, Ltd. (2,070,651)

Airplane engine mount. Frank R. Canney, Seattle, Wash., assignor to Boeing Aircraft Co. (2,070,782)

Control surface. Leonard Eugene Root, Santa Monica, Calif., assignor to Douglas Aircraft Co., Inc. (2,070,809)

Orientation device. Horace




Stark, Detroit, Mich. (2,069,285)

Airplane construction. George E. Barnhart, Pasadena, Calif. (2,070,705)

Horsepower meter. Wladimir A. Reichel, Philadelphia, Pa., Clinton H. Havill, South Orange, N. J., and Morris F. Ketay, Brooklyn, N. Y., assignors to Bendix Aviation Corporation. (2,070,842)

Air vehicle. William H. Boyes, Brooklyn, N. Y., assignor of one-half to Murry Kopita and Joseph Wasserstein. (2,070,854)

Projectile. Bryan P. Joyce, East Orange, N. J., assignor to American Armament Corp., (2,070,946)

Noiseless device. Herbert Luther Adams, Washington, D. C. (2,071,012)

Combined throttle and brake control for airplanes. Luis de Florez, Pomfret, Conn., and Emmon Bach, New York, N. Y.; said Bach assignor to said De Florez. (2,071,063)

Gun sight. John P. Gaty, Woodside, N. Y., assignor to Fairchild Aerial Camera Corp. (2,071,066)

Piston for an internal combustion motor. Elmer C. Long, Grosse Pointe Park, Mich. (2,071,131)

Indicating device. Lawrence A. Hyland, Washington, D. C., assignor, by mesne assignments, to Bendix Radio Corp. (2,071,284)

Aeroplane wing structure. Archiebald S. Barkley, Detroit, Mich. (2,071,317)

Apparatus for following a target. Karl Papello, Jena, Germany, assignor to the firm N. V. Nederlandsche Instrumenten Compagnie "Nedinsco". (2,071,424)

Calculating apparatus for firing directors for shooting at moving aerial targets. Karl Papello, Jena, Germany, assignor to the firm N. V. Nederlandsche Instrumenten Compagnie "Nedinsco". (2,071,425)

Propeller for aircraft or the like. Walter W. Everts, Baltimore, Md. (2,071,513)

Streamline mount for miniature bombs. Clem G. Trimbach, Kenmore, N. Y., assignor, by mesne assignments, to Curtiss-Wright Corp. (2,071,594)

Aeroplane. Henrik Anathor-Henrikson, West Englewood, N. J. (2,071,744)

Retractable landing gear for aeroplanes. René Lucien Lévy, Montrouge, France, assignor to Societe d'Inventions Aeronautiques et Mecaniques S.I.A.M. (2,071,884)

Aeroplane construction. William F. Crowe, Los Angeles, Calif. (2,072,029)

Aerial propeller. Emile Claude Berger, Orsay, France. (2,072,196)

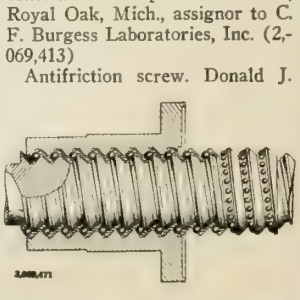
Aeroplane. Charles Nelson Pogue, Norwood, Winnipeg, Manitoba, Canada. (2,072,277)

Valve gear for internal combustion engines. Bernhard Bischof, Winterthur, Switzerland. (2,072,291)

Airplane having a variable lifting surface. Jacques Gerin, Boulogne-sur-Seine, France (2,072,299)

Sound and vibration damping construction. Ralph L. Leadbetter, Royal Oak, Mich., assignor to C. F. Burgess Laboratories, Inc. (2,069,413)

Antifriction screw. Donald J.



Baker, Pasadena, Calif. (2,069,471)

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CHANCE VOUGHT AIRCRAFT, DIVISION OF UNITED AIRCRAFT CORPORATION, EAST HARTFORD, CONN.

# AERO *RADIO* DIGEST

## Newest Developments in the Field of Aircraft Radio

### RCA D-Fs for American

Eight RCA aircraft radio direction finders (AERO DIGEST, Aug. 1936) have been installed by American Airlines, Inc., on their Flagship Sleepers. This increases the total of radio receivers carried by each Sleeper to four: long-wave beacon, short-wave airline, battery-operated emergency, and the radio compass.

Non-stop sleeper service will continue following radio range beacon routes, as before, but will use the D-Fs as an auxiliary method of radio navigation and position check, as well as to guard against rain and snow static.

The electrostatically shielded loop of the RCA compass is housed in a small streamlined bakelite nacelle, 24" long by 9" in diameter, mounted underneath the fuselage. The apparatus is remotely controlled from a control head on the instrument board, and directional reading is given by a left-right visual indicator mounted in a standard round instrument case.

Exhaustive service tests showed good performance under adverse conditions, with precipitation static greatly reduced. With the unshielded sense antenna connected, the apparatus is free from precipitation static under all except the most severe static conditions, when the sense antenna is disconnected and only the shielded loop is used. Provision is made in the cockpit for disconnecting the sense antenna in order to use the receiver as an aural null-point direction finder. Non static interference at the streamlined nacelle has been observed.

For several months past American Airlines have been conducting performance tests on various types of aircraft D-Fs with a view to selecting the final type for their entire fleet of 54 airplanes (and 12 more Flagships now on order). In addition to the RCA D-Fs on the Sleepers, the airline also has 2 Bendix visual D-Fs on DC-3 Douglas airplanes, as well as 1 Radioguide and 1 aural type D-F on DC-2s. Tests indicate that the final instruments to be adopted will be of the visual type, and the company intends to make the final decision and outfit the balance of the fleet with aircraft D-Fs before October 1.

### Proposed B-L System

Novel blind landing system has been proposed by E. M. Sorensen, of Wright Field, Ohio, and assigned by him to the War Department for patent protection.

The system is predicated on the use of a highly directional ultra-high frequency beam projected from the aircraft to the fog-bound airport, where the beam excites one or more receivers spaced about the airport. The receivers so excited operate audio-frequency oscillators, and these signals, received aboard the airplane, are made to operate appropriate lights on the indicator dial, by a system of selective relays.

The ground equipment proposed by the inventor would consist of a number of ultra-high frequency (300,000 kc.) receivers, equally spaced over the field, each receiver serving a plot 1200 ft. square. A relay-controlled audio oscillator is proposed for each such plot, radiating its identifying note non-directionally. The oscillator would operate only when its controlling receiver is excited by the landing beam, transmitted by the aircraft, falling on that plot.

For longitudinal indication, two marker beacons are proposed for each side of the field. The marker beacons, one located about 3 miles from the boundary, the other 1500 ft. from the boundary, operating on the identical principle when their controlling receivers are excited by the directional marker beam transmitted vertically downward by the aircraft when passing over the markers.

For landing intelligence aboard the aircraft, an ultra-high frequency (300,000 kc.) transmitter is proposed, radiating a narrow beam adjusted to coincide with the normal glide path. This beam, when falling on one or more receivers on the airport, causes the receiver-controlled audio oscillators to transmit their identifying notes.

Identifying notes, received aboard the aircraft, cause appropriate lights to flash on the indicating dial, which can be rotated to coincide with the actual landing direction.

Marker beacon audio oscillators, excited by a separate ultra-high frequency directional beam transmitted downward, operate, in the identical manner, the appropriate blue and green lights on the indicating dial.

Original orientation of the aircraft with respect to the landing area is relegated to a conventional radio direction finder, and the system is employed only for the actual landing.

While the system at present is in its patent stage, and little experimental work has been done with the proposed equipment, accomplishment of such highly directional radiations as proposed here would be a signal achievement in radiophysics.



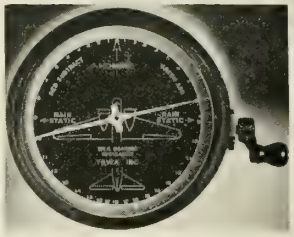
*RCA aircraft D-F as recently installed by American Airlines*

### TWA D-F Dial

Dial calibration in the TWA loop D-F (AERO DIGEST, Mar. 1937) incorporates a correction for the electro-magnetic effect of the airplane structure which ordinarily distorts the incoming wave front. The degree marks on the dial indicate the direction of the incoming signal, and not the physical position of the loop.

The dial shown is calibrated for the standard TWA loop location in their Douglas DC-2s. Since the loop is mounted slightly off the airplane's center, the correction for the electromagnetic effect is not identical for equal bearings to port and starboard.

The loop serves as a direction finder when oriented at right angles to the incoming signal (null position); with its plane oriented to coincide with the direction of the incoming signal, the loop is used for audio reception (maximum position). The loop is electrostatically shielded, eliminating interference from rain and snow static.



*TWA Direction Finder dial*

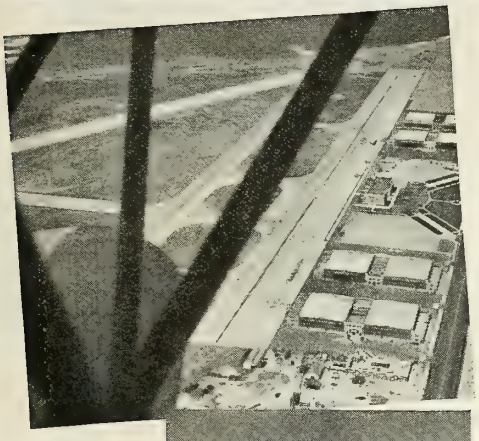
### New Radioguide

Model "E" Simon Radioguide (AERO DIGEST, Jan. 1937) has been completed by Radio Navigational Instrument Corp., of New York, and the first of the new instruments is now undergoing flight tests in an American Airlines Douglas.

As in the preceding models, Model E employs the ratio principle of radio direction finding. Two vertical electrostatically shielded loops are fixedly disposed at equal but opposite angles to the longitudinal axis of the airplane; the loops respond to the incoming signal in accordance with the cosine law (responsiveness to signal varies as the cosine of the angle between the plane of the loop and the direction of received signal). Signal intensities induced in the two loops are equally amplified by a special superheterodyne receiver with two balanced amplification channels, and are measured by two crossed milliammeter pointers, the deflection of each pointer being proportional to the signal intensity induced in its corresponding loop. Since the ratio of signal intensities in the two loops is constant for any given bearing, it is possible to calibrate the indicating dial for a direct reading of that bearing in degrees, irrespective of variations in signal strength or distance from the station.

The two loops of Model E are built in a single concentric unit, and are housed in a watertight streamlined Formica nacelle, 27" long, 10½" in diameter, 13" high overall including foot, and mounted on top of the fuselage.

IN THE AIR AND ON THE GROUND IT'S RCA ALL THE WAY!





• Happy Landing Ahead! The plane, equipped with RCA Aviation Radio Apparatus, circles the airport before pilot "sets her down."

• DuPont Airport, Wilmington, Delaware, has 4 RCA AVR-11 Receivers with AVA-8 Crystal Control Units. Also a remotely controlled radio-beacon-radio-telephone which is located a mile away.

# There's the Field!

**...seeing "home" after RCA Aviation Radio has led you there safely by sound!**

*75% of America's Airports and planes using them are RCA equipped*—proof *of RCA superiority!*

Thousands of miles are behind you..miles which saw you best a blizzard over the Rockies..dodge a thunderstorm west of Chicago ..fool an overcast at Newark. And now you're "coming in"—*safe,* thanks to the RCA Aviation Radio equipment in your plane.

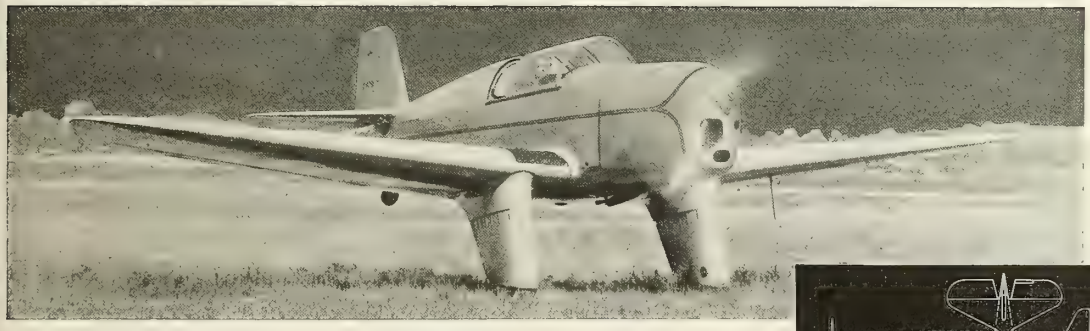
Confidence is a grand feeling when you're flying. And confidence is yours with RCA products at your command. RCA equipment for planes and airports has come to be a symbol of safe flying. That's why 75% of the nation's landing fields and nearly all the planes that use them are RCA equipped.

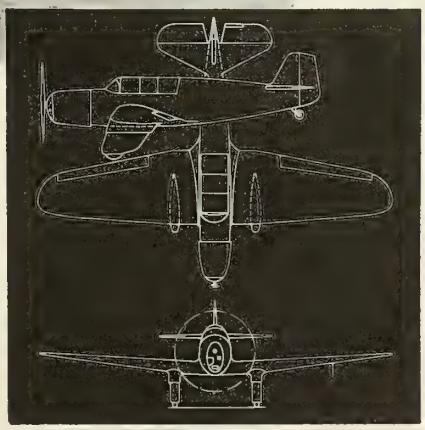
Enjoy the advantages of this better apparatus in *your* plane. Fly—with the convenience and safety of radio that's RCA ALL THE WAY. Very low cost! Ask about RCA's radio compass for planes; varied types of airport and aircraft transmitting and receiving equipment. Fly with RCA—the safety way!

RCA *for Aviation Radio*

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*RCA Aviation Radio Instruments are sold by* AIR ASSOCIATES, INC., Glendale, Calif.; Chicago, Ill.; Garden City, L. I. . . . or write direct to Aviation Radio Section, RCA Manufacturing Company, Inc., Camden, N. J.





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Wing Span—31 feet. Wing Area—140.5 sq. ft.
Standard Power Unit—125 H. P. or 150 H. P. Menasco Motor.
A low wing, two place plane that is fast and rugged and sets new standards of performance.

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# Digest of Technical Articles from Foreign Publications

## Aerodynamics

*Determining Aerodynamic Characteristics of Airplanes (Sur l'Appréciation de Qualités Aérodinamiques des Avion; Michel Précoul. l'Aeronautique; No. 211,, Décembre* 1936)

Aim of this article appears to be twofold: to determine comparative efficiencies of airplanes of similar type, and to offer a simplified way which, from the knowledge of such data as is ordinarily published will provide the three most important aerodynamic characteristics defining the design. The latter are the maximum ratio of lift over drag, maximum lift and minimum drag. Derivation of the formulas and curves of the method are based on the well-known parabolic approximation of the polar. The analyses of certain types of popularly known airplanes seem to indicate a fairly accurate approximation possible by the use of the method proposed.

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*Tests of Aerofoils R.A.F.* 69 *and R.A.F.* 89, *With and Without Split Flaps, in the Compressed Air Tunnel; D. H. Williams, B.Sc., A. F. Brown, B.Sc. Air Ministry (Great Britain); Aeronautical Research Committee; R. and M. No.* 1717; *May* 1936

Use of thick sections for wing profiles has become common with the development of internally braced cantilever monoplanes and with the use of tapered wings. The thickest sections tested in the compressed air tunnel have been of the order of 15%, and to obtain information regarding the behavior of thick sections at high Reynolds numbers, two RAF sections 21% and 25% thick were tested. The minimum drag of such sections is found to increase rapidly with thickness whereas the maximum lift decreases as the thickness is increased except at low values of Reynolds number. The addition of flaps, however, increases the maximum lift to the same value as that for a thin section with flaps.

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*Effect of Surface Roughness on the Characteristics of the Aerofoils NACA* 0012 *and RAF* 34; *R. Jones, D.Sc. and D. H. Williams, B.Sc., Air Ministry (Great Britain); Aeronautical Research Committee; R. and M., No.* 1708, *February* 1936

Predictions from work on rough pipes suggested that surface would increase the drag of an aerofoil at high Reynolds numbers. Experiments have been carried out in the Compresses Air Tunnel on the NACA 0012 airfoil (a) with the usual finish, (b) with the surface chromium plated and (c) with the surface coated with carborundum powder to two degrees of roughness; also on the RAF 34 airfoil (a) with the usual finish, (b) with the entire surface roughened and (c) with only back-half roughened. Tests were made for a wide range of Reynolds numbers at angles of incidence up to 28.5°. It was found that surface conditions had a large effect on maximum lift and minimum drag at high Reynolds numbers.

## Airports

*Airports—Their Geometry and Use (Campi a'Aviazione—la Loro Planimetria ed Ubicazione; Giorgio Basevi. l'Aerotecnica; Vol. XVI, No.* 12, *Dicembre* 1936)

Characteristics of flying fields and airports are naturally subordinated to the type of service for which they are intended. The article distinguishes about eight different types which could be decreased to four main groups—commercial, military, emergency and private. The contents are evenly divided between chapters on the selection of location, nature of soil, surfacing and drainage, topography and layout. The only example of an actual airport illustrating the article is that of Lambert—St. Louis Field.

## Experimental Research

*High Speed Wind Tunnels (Gallerie Aerodinamiche per Alte Velocita; J. Ackeret. l'Aerotecnica; Vol. XVI, No.* 12, *Dicembre* 1936)

This paper was first presented by Ackeret at the Fifth Volta Meeting in Rome devoted to the problems of high speeds in aircraft. The author outlines the purpose of various wind tunnels, subdividing them into major groups according to Mach's number *M*. Ackeret designates those tunnels for which *M* (the ratio of operating speed to the speed of sound) is below unity as subacoustic while those for which it is unity or above are classed as superacoustic. The problem of this research is further complicated by the fact that high speeds are normally associated with high altitudes with their attending low temperatures and consequent increase in Mach's number. The article clearly outlines the thermodynamic and fluid dynamical phases of the problem, and contains technical descriptions and analyses of a few of the most important high speed wind tunnels.

## Elasticity

*Thin Sections in Torsion. The Direct Stresses Developed in Open Sections with One End Subject to Constraint; W. J. Goodey, M. A.; Aircraft Engineering, Vol. VIII, No.* 94; *December,* 1936

The problem of torsion of thin-walled hollow cylinders is generally solved by applying the Batho formula commonly known as membrane analogy. For open sections this method is inapplicable and such sections offer small torsional stiffness unless they are built-in so as to restrict warping. This additional constraint results in direct stresses which are somewhat analogous to the stresses present in any hollow cylinder subjected to torsion and restrained by the presence of bulkheads, condition of symmetry, and end condition. The author analyzes this problem and gives the formulas which can be used to approximate the effect of constraint of such structure as box beams near their anchorage planes.

## Spinning

*Interim Report of Systematic Model Research In Free Spins; Low-Wing Monoplanes; R. H. Francis, M.Sc. Air Ministry (Great Britain), Aeronautical Research Committee; R. and M. No.* 1714, *January* 1936

Properties of a series of wing arrangements fitted to a standard fuselage and tail unit have been explored over a wide range of mass distributions in the free spinning tunnel. The present report describes tests of low-wing monoplanes.

The fuselage and wing tips of a monoplane with rectangular planform wing were loaded in steps to cover the extremes of modern practice, and at each loading the model was tested by the applied yawing moment method. Comparative tests of a tapered low-wing monoplane were made at two loadings. The effect of wing tip slots was tried on the rectangular planform wing, and of split flaps on the tapered wing.

## Spinning

*Some Experiences and Lessons Learned in Spinning Aeroplanes. James B. Taylor, Jun., A.F.R. Ae. S., M.I. Ae. S., M.A.S.E.; The Journal of The Royal Aeronautical Society; Vol. XLI, No.* 313; *January* 1937

A non-technical presentation of the problem of spinning and the author's experiences in actual flight testing. The article is interesting from the viewpoint of giving a technical test pilot's credo of spinning. It is unfortunate that no data accompanies the reported observations. Only passing mention is made of the free spinning tunnel and the correlation of model tests with actual spins.

## Air Transportation

*The Economics of Air Line Operation, L.T.H. Greig; The Journal of the Royal Aeronautical Society, Vol. XL,* No. 312, *December* **1936**

A more proper title for this paper would have been "The Psychology of Air Line Operation." There is no mention made in the paper on the cost of running an airline but the paper is interesting because it gives a good picture of conditions, which British airlines are confronted with as well as the complications brought about by Europe's proximity. There are certain passages discussing the psychology of service and business approach to equipment which are also worthy of consideration.

## Operations

*Fueling of Airplanes (Le Ravitaillement des Avion et Hydravions en Carburants; Jean Retel. l'Aeronautique; No.* 212, *Janvier* 1937)

A most interesting and well illustrated article discussing fixed and mobile service stations, equipment, problems of transportation of fuel, service demands of speed, etc. The growing size and number of aircraft makes the topic timely. In the accompanying illustration A and A, indicate the high-speed pump connections; B the adjustable coupling; C, 5000-gal. tanks; F, filters and indicating meters; G, pumps; K, control post; and T, hose winding drum.

(*Continued on page* 78)

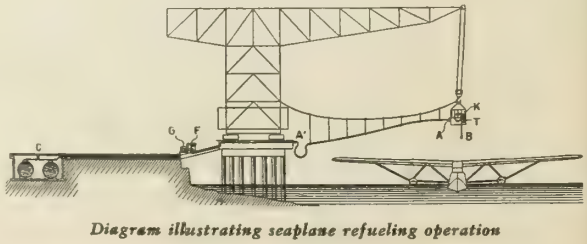



***Diagram illustrating seaplane refueling operation***

# A MILLION PASSENGERS



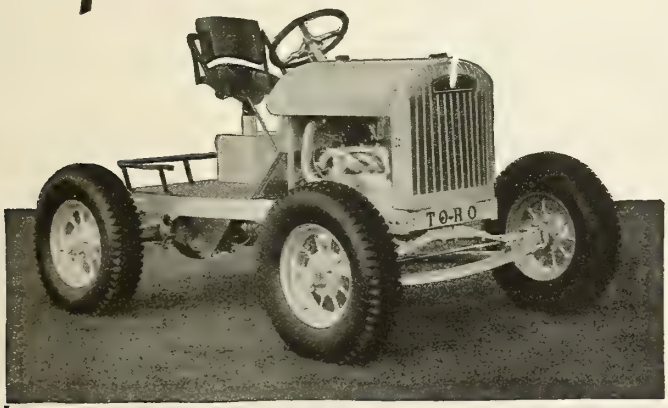
. . . have traveled on American Airlines—a milestone in the story of commercial transportation. Packard plays an important role in this march of progress, for Packard cable is standard equipment on the great Douglas Flagships of the American Airlines' fleet. Dependability, the foundation on which American has built this huge volume of traffic, demands the best in every detail of airplane construction. That is why leading airlines, as well as army, navy and private fliers, choose Packard. Packard Electric Division, General Motors Corporation, Warren, Ohio.

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Toro Husky A Tractor that Really Meets Airport Requirements




A short coupled, sturdy, powerful, fast, utility machine that competently handles towing, shunting, hauling, mowing and snow plowing. A real help in year 'round airport maintenance. A reliable tractor that stands ready to perform to satisfaction whenever called upon.

**Interesting Facts**

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| Wheel Base | 71 inches |
| Turning Radius | 6¾ feet |
| Motor | Ford 40 H.P. Self Starting |
| Gear Shift | Standard 3 Speed |
| Wheels | Pneumatic tires or steel with Spiked rears |
| Speed Range | 15 miles in High<br>7 miles in Intermediate<br>3 miles in Low |

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3042 SNELLING AVENUE MINNEAPOLIS, MINNESOTA

# EQUIPMENT and METHODS

## Anti-Ice Solution

To prevent ice formations near the hub of propellers, Chicago & Southern Airlines is using a solution consisting of 15% glycerine and 85% *Solox*, the latter a proprietary alcohol-type solvent made by U. S. Industrial Alcohol Company.

In the "slinger ring" installation (AERO DIGEST, February 1936) gravity feed is used to convey the solution from a reservoir tank in the engine housing through the propeller shaft into a small trough around the propeller hub. As the propeller revolves, centrifugal force throws the fluid out through a small outlet to the propeller surfaces. Flow is regulated by a control in the cockpit.

In the past it has been found that when heavy coatings of ice form on the propeller close to the hub, large pieces may break loose to be thrown against the side of the fuselage or against the nacelles causing dents. Sometimes ice may break off one blade only, leaving formations on the other blade or blades and causing excess vibration.

## Dial-Controlled Metal Sawing

Featured in the *Doall* contour sawing machine just developed by Continental Machine Specialties, Inc., is a dual dial control which gives the correct speed of the saw for various materials and thicknesses of job.

Inasmuch as different thicknesses of work and different materials necessitate different sawing speeds for contour sawing and for filing or polishing, the new control dial provides more efficient use of the contour machine.



The dial is built into the machine, being mounted on a hinged door. After the manner of radio dial selections, this dial lists 48 different materials in alphabetical order around the rim, beginning with aluminum and ending with zinc. The list includes several trade-marked materials such as Monel metal, as well as the ordinary metals and materials used in manufacturing. One blank space on the dial permits listing of any material developed in the future.

In addition to dialing the correct sawing and filing speed, this control translates the correct saw to use for each material, showing the proper selection of saw as to "pitch," "temper," and "set" for each of the materials listed. Other refinements in the new machine are an improved lap grinder and a new wider adjustment in the saw guide.

## Oxygen Regulator

Automatic and positive supply of oxygen to pilots operating at high altitudes is available through use of the Model 0-5-A oxygen regulator developed by Gaertner Scientific Corporation. This instrument features dependability under all operating conditions, light weight, compactness and ruggedness, and is unaffected by vibration or temperature changes.

Mounting may be on the instrument panel or in any part of the ship. High pressure oxygen is supplied according to predetermined requirements for various altitudes from tanks available in 80, 83 and 160-gal. capacities.

In operation, the regulator reduces the pressure and supplies the correct amount of oxygen according to altitude. Pressure reduction takes place in two stages: first from the tank, with pressure ranging from 2200 lbs. to 300 lbs./in.$^2$, the reduction being obtained in a chamber by accurately controlled spring pressure. The second reduction is provided automatically by the aneroid.

There are three non-corrosive control valves: a tank shut-off; emergency by-pass, and manual. The tank shut-off valve permits closing the supply to the regulator, with the exception of the line to the pressure gauge and to the emergency by-pass line and valve, the latter permitting oxygen flow even though the automatically operating parts have been injured. When it is in the "on" position, this valve by-passes a flow of oxygen with a tank pressure of about 1800 lbs./in.$^2$ approximately 55 gals./min. The manual valve is used for varying the basic oxygen flow delivered by the automatic valve to suit varying requirements according to exertion and constitution.

The complete unit consists, in addition to the above, of a relief valve provided as a safety measure, a filter, supply tank pressure gauge and a record flow chart indicating the flow of oxygen in liters per minute at various altitudes for different positions of the manual valve. Also there is a high pressure connection tube, a flexible stainless steel tube, manifold for connecting two tanks to the high pressure tube, a mouthpiece and a face mask.

The regulator is connected by a copper tube to the oxygen tank. The flexible tube, with the mouthpiece, is attached to the outlet of the regulator. When the tank "shut-off" valve is opened the regulator automatically starts to deliver oxygen at an altitude of about 15,000 ft.

## Piston-Ring Compressor

A piston-ring compressing outfit is being marketed by Wilkening Mfg. Co. The equipment consists of a clamp unit and a series of sleeves in sizes and types to handle most efficiently any piston ring installation.

Compression of the ring is at exactly the right point—over the piston ring area. After compressing the rings to the correct amount, the compression clamp can be moved along the sleeve to the edge of the cylinder, thus assuring correct compression of the rings at the point where they enter the cylinder.

Rings can be drawn tight simply by the screw clamp, and the sleeve does not "give" or let go of the rings at any time until they enter the cylinder. The clamp instantly releases itself from the sleeve after installation.

## Hydraulic Portable Spot Welding Gun

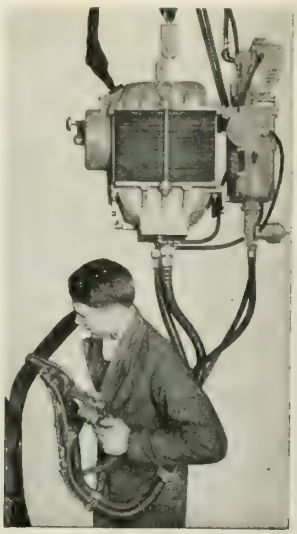
Utilizing the principle of hydraulic pressure to obtain a more perfect fusion of metals by a squeeze action, Progressive Welder Co., has developed a portable self-lubricated production spot welding gun for production work.

The principle of hydraulic actuation, new in portable spot welding, allows welding of identical or different gauges by an output of greater pressure and finger tip adjustment. Also, hydraulic operation makes a small, lighter and more compact hand welding gun, and eliminates delicate working parts.

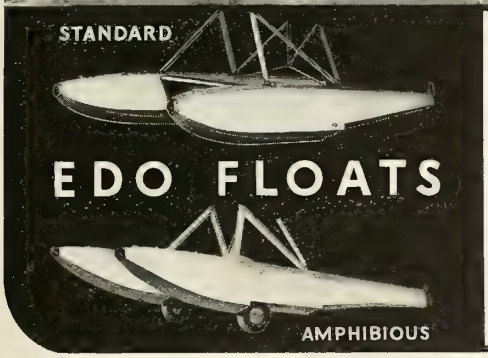
The complete unit consists of an overhead mounting on a swivel-type hanger giving a working radius of about 12 ft.; a compact gun and water-cooled flexible cable assembly; 50 or 75 k.v.a. transformer with a hand-operated switch to control different welding conditions; and a finger tip controlled hydraulic booster capable of pressure ranges from 0 to 3000 lbs.

Three types of guns are available as are a variety of points, adapters and yokes to accommodate any shape or section. The welding gun can be used without a balancer or cable and electrical current control by modern timing devices is provided.

Features of the Progressive welder are saving of floor space, elimination and combining subassemblies, fast action, and reduction of production cost.






Where the crowds go seaplane operators reap a harvest of freely spent dollars. Waterfront hotels and resorts (how few are *not* on lake, stream or shore!) welcome the amazingly quick transportation which an EDO-equipped plane offers. And always there are vacationists glad to make a sight-seeing plane trip the high spot of their stay, as well as men and women whose affairs demand air-commutation to the city and back.

Get your share of this profitable business—equip your plane to land and take-off at the very door of America's most popular resorts and biggest cities —by fitting EDO Float-Gear, Standard or Amphibious. Write for full details to Edo Aircraft Corporation, 610 Second Street, College Point, L. I., N. Y.

This advertisement appears of record only and is not, and is under no circumstances to be construed to be an offering of these Shares for sale or a solicitation of an offer to buy any of such Shares. The offering is made only by the Prospectus.

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**187,500 Shares**

# Brewster Aeronautical Corporation

**(A New York Corporation)**

**Capital Stock**

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**Price $5.50 per share**

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Copies of the Prospectus may be obtained from the undersigned.

## VAN ALSTYNE, NOEL & CO.

**52 Broadway, New York**

April 8, 1937.

# HOWARD MODEL DGA-9

**Technical details of the new four-place commercial monoplane by its designer,**

***BEN O. HOWARD***

● In introducing the new Howard models to the private owner and business executive, Howard Aircraft Corp. has endeavored in the design, structure and equipment to make airline performance and reliability the keynote.

During a period of 16 years of study and observation, 12 years of experimenting and building and seven years of constant airline flying, we have learned what may be accomplished in aerial transportation. As racing planes were the only experimental planes that were self-supporting, our primary experiments were conducted with this type of equipment, developing from strictly small racing planes to the cabin type, which was the forerunner of the present commercial Howard DGA-8 and 9, the latter powered by the 285 hp Jacobs L-5 engine. Our racing experience has proven advantageous in that the structural details and requirements necessary for these planes have better enabled us to anticipate the requirements for a commercial plane.

It is imperative that high speed equipment be structurally sound. Our design was based upon a 320 mph diving speed, which allows us to placard a "Never exceed speed" of 288 mph, which is probably the highest placarded speed of any commercial plane.

Fuselage of the DGA-9 is of all welded chrome molybdenum steel tube structure, fabric covered with soundproofed metal used for the entire length of the cabin. Wings have two solid spruce spars with truss type spruce ribs and are externally braced, wing section being the NACA $2R_2$ 12. The wing is entirely covered with plywood, which, in turn, is covered with fabric for finish.

Use of high lift flaps, each of which has a span of 8 ft. 6 in., allows steep descent and a landing speed of less than 50 mph. A safety release is so arranged that, in the event of "overshooting," the flaps automatically raise as the throttle is opened and the speed increased. They return to the down position again as the throttle is closed and the speed is decreased for the next approach for landing. Extraordinarily high wing loading, made possible by the use of these flaps, assures an unusual smoothness even in rough air at high speeds.

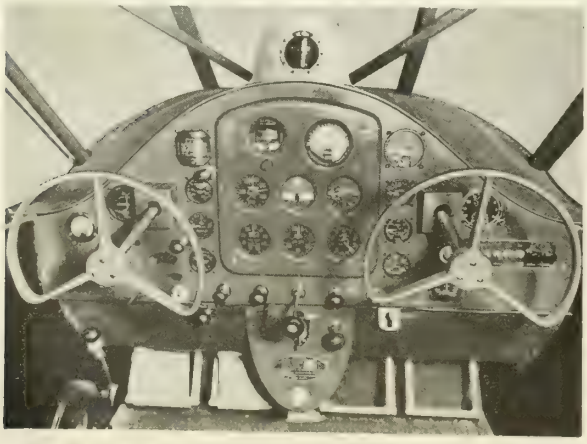
Fuel is carried in tanks located beneath the cabin floor, supply to the engine being through an engine-driven fuel pump and auxiliary wobble pump. The advantages of having tanks below are so numerous that the extra expense involved in such an installation is well justified. Fuel supply is positive and vapor locks common to gravity systems are eliminated. It also does away with the necessity for climbing over the plane when servicing, as well as eliminating spilling. The attendant may stand with both feet on the ground while observing fuel flow into the tank fillers. No tendency for wing heaviness occurs as is sometimes the case where wing tanks are employed and the contents of which are drained one at a time. Top-heaviness which requires wide landing gears does not exist in the lower center of gravity position and a cleaner and more efficient undercarriage is made possible. In addition, the fuel tanks may be removed and replaced for inspection or repair within a few minutes without disturbing the finish. In the DGA-9, the cg is located 6.3 in. back of the leading edge of the wing in the nose-heavy condition and 17.3 in. back in the full-load condition; and 2.83 in. and 1.42 in. above the centerline of thrust, respectively.

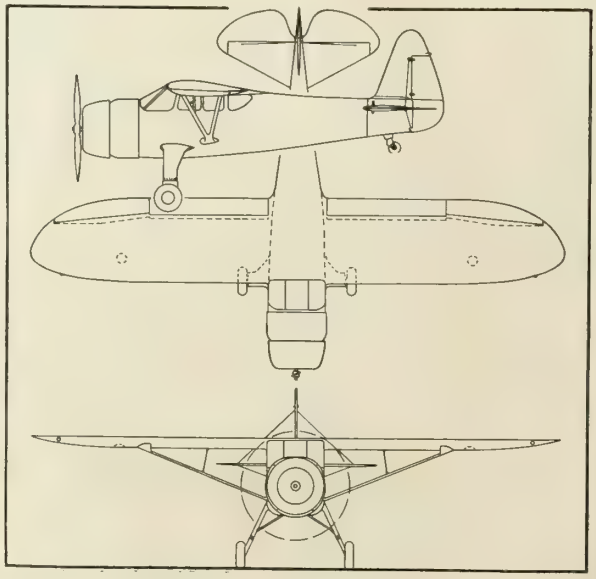
Servicing of the engine and accessories has been a subject of careful consideration. Access to the engine group including oil tank, radiator, and battery is easy since it is possible to remove the entire cowling including the NACA cowl within a short time. There is ample room between the engine and firewall to work on accessories, thus tending to reduce the cost of maintenance and repair.

The passenger cabin is large and roomy with special attention given to leg room. Front seats are adjustable fore and aft as well as vertically and are spring balanced for ease of operation. Rear seats are of the hammock type insuring maximum comfort. With the front seats fully back, there is plenty of leg room for those in the rear seat. Aft of the rear seat, a large baggage space is provided, with access from the outside; provision of a door release from the cabin eliminates the usual exposed door handle. Space also is provided behind and above the rear seats for hats, gloves, etc. Soundproofing of the cabin has been thorough and has reduced the noise level to a minimum.

The instrument panel is so arranged that the primary flight and engine instruments are directly in the center, flanked on either side by supplementary units, the radio dial and electrical switches. Directly beneath the center panel is the throttle, mixture and propeller pitch control, all of the Arens lock-

(*Continued on following page*)





***Instrument panel and outlines of the Howard DGA-9 commercial plane***

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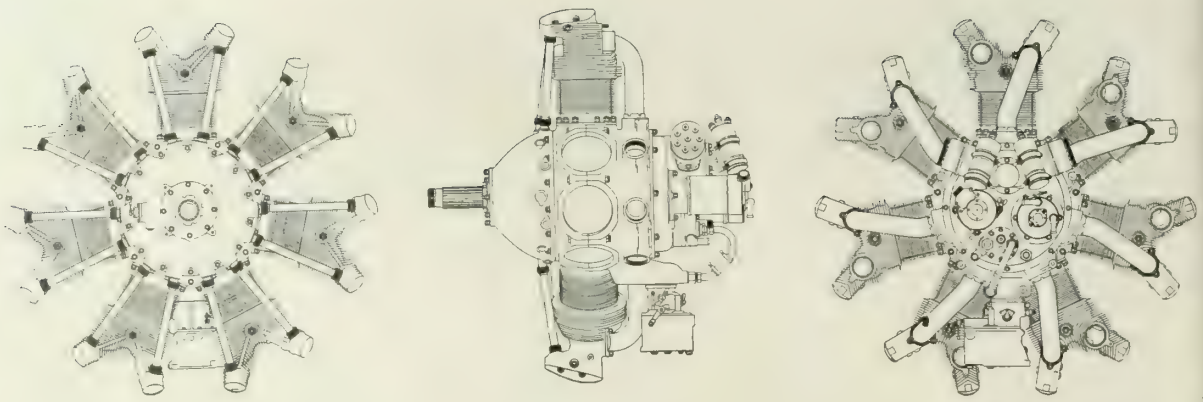
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*Outline drawings of the 285 hp Jacobs L5 engine which powers the Howard DGA-9 monoplane*

(*Continued from preceding page*)
ing type, wobble pump and fuel tank selector switch. Above the center of the panel is the compass. Instruments include Kollsman airspeed and vertical speed indicators, manifold pressure gauge, and altimeter; Pioneer turn and bank indicator; Air Associates tachometer; fuel gauge, carburetor temperature gauge, clock, ammeter, oil pressure gauge.

Control wheels are dual and of the automobile-type projecting through the instrument panel. The linkage has been worked out to eliminate any unnatural vertical movement of the wheel in the extreme inward or outward position. Rudder controls are of the stirrup type with toe-operated hydraulic brakes and parking set, a type of brake used on most of the transport airplanes and one that has become standard for the Army and Navy. Use of the automobile-type control and stirrup-type rudder control leaves the floor clear of obstructions.

Tail group is of welded steel tubing and channel sections, wire braced. A fixed cantilever type landing gear with a tread of 7 ft. 9 in. is used. Equipment consists of Goodyear tires, wheels and hydraulic brakes and a Howard-designed oleo and spring shock absorbing system. Each leg is faired with a metal housing.

Specifications and performance figures of the 285 hp Jacobs-powered DGA-9 are as follows:

| | |
|---|---|
| Wing span | 38 feet |
| Overall length | 26 feet 5 inches |
| Wing area | 185.52 square feet |
| Empty weight | 2150 pounds |
| Useful load | 1650 pounds |
| Gross weight | 3800 pounds |
| Fuel capacity | 60 gallons |
| Oil capacity | 7 gallons |
| Cruising speed | 166 miles per hour |
| Landing speed | 48 miles per hour |
| Rate of climb | 1200 feet per minute |
| Service ceiling | 18,000 feet |
| Cruising range | 650 miles |


ANOTHER

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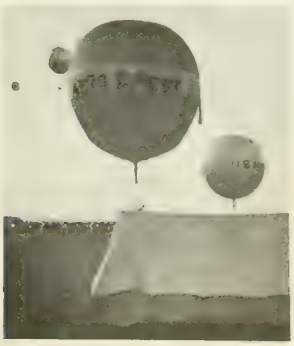

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# Personalities

by Caldwell

● Samuel Taylor Moore, World War balloonatic, internationally known literary pundit, ghost-writer to famous pilots, war correspondent, pulp-paper fictioneer, publicity director extraordinary, and God's gift to amateur theatricals, was born of rich but honest parents in Westfield, Mass., on June 24, 1893. Sam is the Dr. Johnson of aviation, and it is indeed an honor for me to act as his humble Boswell, for he has written (and Greenberg of New York has just published) a very fine book, *America and the World War,* the first complete story of America's part in that war ever to be published in one volume. If you would understand how the United States got into that war—and not one American in a dozen has the haziest idea why—read this book. You may be surprised to learn that we should have fought England first and Germany afterward; you may also be startled to know that if we had possessed an army that wasn't a joke and an Air Force that was just out of its diapers, we wouldn't have had to fight any nation, for the simple reason that we would have been respected for our strength and neither England nor Germany would have dared to pull feathers from the eagle's tail. For confirmation of this, you also should read *The Road to War,* by Walter Millis. Those two books should be required reading for every Senator and Congressman able to read anything heavier than detective stories, the standard cultural diet of politicians.



*Sammy's racing balloon of 1930 ready to go with the wind*

As this is a sketch of the great pundit himself, and not a book review, I have no space to mention the many excellent qualities of this fast-moving, plainly-written story of America's participation in the great international flim-flam game of "Idiot's Delight," which is war's alias.

### Early Perspicacity

Sam Moore gave early indication of the giant intellect that he eventually would become; for even as an infant he was smart enough to select rich parents. It was the horse and buggy era—we're in the hoarse and bughouse era now—so as Sam was getting his first flight with Old Man Stork he looked down as they were flying over Westfield, then known as the Whip City, because 85% of the horsewhip production in the United States was centered there. Selecting the mansion of Sam Moore, Sr. (Moore's whips were unfavorably known by every horse in the country), young Sam told the Stork to let him off, so the noble bird dumped him down the Moore chimney, which fortunately was cold as it was June. What Sam couldn't foresee was that two men named Selden and Ford were working hard to put all horses on Relief by producing the automobile. By the time Sam was a youth horses were getting scarce, and the Moore family fortune looked as though an income tax collector, or moths, had been at it. So Sam had to go to work. He realized then that he should have got off at Detroit originally, even if he had to carry through life a name like Edsel. Incidentally, Mr. Ford had intended to call his son Ed—just plain Ed. When the child was christened, Henry had been having trouble with the Ford car axle, so when he was asked the youngster's name, he was thinking of the axle, and instead of saying Ed, he got mixed up and said "Axle—I mean Edsel," and it stuck to him ever since.

Sam's first job was running a street car, another vanishing vehicle. He was hired as conductor, but ambition unfortunately led him to act unofficially as motorman; he ran the car off the tracks and was fired. The same pathetic fate recently happened to Eugene Vidal, who ran the Department of Commerce trolley off its tracks. I met the new motorman, Director of Air Commerce Fagg, now at the controls. Let's hope the creaky vehicle lumbers along more comfortably from now on, and that Col. J. Monroe Johnson has sense enough to leave this man alone and let him see what he can do. Johnson has enough of a mess on his hands with the merchant marine about which he knows nothing, without hampering the government executives in aviation—about which he knows even less. Although I've said that I was against Americans taking part in the Spanish bull fight, I'm in favor of Colonel Johnson going over to fight for either side.

### A Newspaper Man, too

Sam Moore spent four years in newspaper work, and in 1916 became a full-fledged war correspondent with the Pershing Punitive Expedition in Mexico. As that was hardly a war, Sam was only a punitive correspondent—he punished his expense account and his readers, trying to write excitingly about what was only a long hot walk, with fleas. Floyd Gibbons got his start in that same toddle after Villa, who was very much amused at the whole affair, and just walked faster than Pershing and his boys. In 1917 everybody gave up and came home, where they should have stayed in the first place, and Sam went to Washington as White House correspondent of the United Press, but got restless and enlisted in the Balloon Section of the Signal Corps. Captain Charles DeForest Chandler started Sam off as a sergeant—he looked like a sergeant even in those days, and drank like a sergeant major.

He qualified as a free balloon pilot and was awarded F.A.I. License No. 106, was commissioned a first lieutenant in command of the 7th Balloon Company, and sailed for France in January, 1918. When the Kaiser heard of it, he laughed for the first time in weeks. Sam's company was the fourth American balloon outfit to get to the front, and it was good, serving from July to the Armistice, observing for the artillery and leaping out of baskets with great agility. Of some 120 observers shot down in the American balloon service, one sixth, or 20 men, bailed out from baskets in Sam's outfit. The 7th Company was awarded five D.S.C.'s and four Silver Star medals. Sam got a Silver Star. I'll defy him to trade it for a pound of chopped meat at any A & P store. But it's so nice to show to the children.

After the war Sam was associated with Lawrence Sperry, and wrote many expert articles on aviation—he feels rather uncomfortable to-day when he reads them. He has ghosted articles for Clarence Chamberlin, Clyde Pangborn, Charlie Collyer, Ham Lee, Tex Settle, and others. That is, he writes the articles and the famous lads sign them. You must do one for me some day, Sam. And sign it yourself. Among his

(*Continued on page* 93)



*Sam Moore exposing himself to an aeronautical atmosphere*

(Continued from page 52)

$$B_m = \frac{2}{\pi}\int_0^{\pi}\sum_{n=1}^{n=\infty}\sum_{k=0}^{k=\infty}(A_n C_k \sin m\theta \sin n\theta \cos k\theta)\,d\theta$$

$$+\frac{2}{\pi}\int_0^{\pi}\sum_{n=1}^{n=\infty}(n A_n \sin n\theta \sin m\theta)\,d\theta \ldots\ldots (7)$$

Now the integral of any term

$$(A_n C_k \sin m\theta \sin n\theta \cos k\theta)$$

in the double series on the right-hand side of (7) is zero unless $n \pm k \pm m = 0$ and in the latter case it is equal to either

$$\pi/4\ C_k\ (A_{m+k} + A_{m-k} - A_{k-m})$$

or to

$$\pi/4\ A_n\ (C_{m-n} + C_{n-m} - C_{m+n})$$

since the coefficients $A_{-m-k}$ and $C_{-m-n}$ are zero.

The second integral on the right-hand side of (7) is zero unless $m = n$; in which case it is equal to $(m\pi/2)(A_m)$. Then the general $B$ coefficient is

$$B_m = m A_m + \frac{1}{2}\sum_{n=1}^{n=\infty} A_n\,(C_{m-n} + C_{n-m} - C_{m+n}). \quad (8a)$$

From (8a) it is seen that the values of the $B$ coefficients (and therefore the required geometrical angles of attack) may be directly determined if the $A$ and $C$ coefficients (i.e., the lift distribution and planform) are given. However to determine the lift distribution when the $B$ and $C$ coefficients are given, we must solve for the $A$ coefficients. To facilitate the latter procedure write (8a) in the following form

$$2B_m = \sum_{n=1}^{n=m-2} A_n\,(C_{m-n} - C_{m+n}) + P_m A_m$$

$$+\sum_{n=m+2}^{n=\infty} A_n\,(C_{n-m} - C_{n+m}) \ldots\ldots\ldots (8b)$$

where $P_m = 2(m + C_0) - C_{2m}$. Now since the $C$ coefficients are zero when $n \pm m$ values are odd, it will be readily seen that the system of equations given by (8b) will break up into two separate groups: one with only odd values of $n$ and $m$, and the other with only even values. Moreover it is also important to note that (8b) is satisfied approximately by neglecting all the terms to the right of $P_m A_m$. When the latter procedure is followed we obtain, successively, the values of the $A$ coefficients to a first approximation; thus

$$A_1 = 2B_1/P_1$$

(Continued on following page)




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"The time taken to fly the 1440 miles was 12 hours 22 minutes, which is an average speed of 116.44 miles per hour. The oil consumption was only one quart, and when drained on return to Hamilton, the oil appeared to be in practically the same condition as when it was put in. The petrol consumption at cruising revs. was 4 gallons per hour. It was not necessary to make any mechanical adjustments whatever.

"On the last stage between Nhill and Adelaide against a head wind, I flew the machine on absolutely full throttle with the airspeed indicator up to 120 miles per hour.

"At no time did the engine show any signs of overheating throughout this gruelling test, and on arrival back in Hamilton, our Ground Engineer removed one cylinder for the purpose of inspecting the condition of the motor, and we were pleasantly surprised to find that pistons, rings, cylinders, etc. were absolutely unmarked and showed no signs whatever of overheating or wear.

"The machine was exceptionally comfortable for such long flights, and the visibility, even in bad weather, was better than most of the high priced cabin machines which I have flown.

"The brakes were a wonderful convenience in taxiing in strong winds into our allotted positions on the aerodromes and the starting lines throughout the race.

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*(Continued from preceding page)*

$$A_2 = 2B_2/P_2$$
$$A_3 = [2B_1 - A_1(C_2 - C_4)]/P_3$$
$$A_4 = [2B_4 - A_2(C_2 - C_6)]/P_4$$

and so forth, on to the general term

$$A_m = [2B_m - \sum_{n=1}^{n=m-2} A_n(C_{m-n} - C_{m+n})]/P_m \quad \ldots\ldots (9)$$

As an example of the use of (9) consider the simple case of the elliptic wing whose planform equation is

$$(2x/b)^2 + (c/c_o)^2 = 1$$

where $x = -(b/2)(\cos\theta)$ as shown in the first article of this series[1] and where $C_o$ is the chord at the center of the span. Then we have

$$c/c_o = \sqrt{1 - \cos^2\theta} = \sin\theta = \mu/\mu_o$$

where $\mu = a_o\, c/4b$ and $\mu_o$ is the value of $\mu$ at the center of the wing.

The $C$ coefficients are calculated as follows:

$$\sin\theta/\mu = 1/\mu_o = \sum C_k \cos k\theta\, d\theta$$

and from (6)

$$C_k = 2/\pi\mu_o \int_o^\pi \cos k\theta\, d\theta$$

$$= 0 \text{ when } k \neq o$$

$$C_o = 1/\pi\mu_o \int_o^\pi d\theta = 1/\mu_o$$

(8b), then gives

$$B_m = (m + 1/\mu_o)\, A_m \quad \ldots\ldots (10)$$

For the elliptic wing

$$\mu_o = a_o\, c/4b = 2\pi\, c\, b/4b^2 = 2S/b^2 \quad \ldots\ldots (11)$$

where $S$ is the total wing area.

When the geometrical angle of attack is constant over the span the $B$ coefficients are given by

$$B_m = 2\alpha/\pi \int_o^\pi (\sin\theta \sin m\theta)\, d\theta$$

$$= 0 \text{ if } m \neq 1$$
$$= \alpha \text{ if } m = 1$$

For the present case $B_1 = \alpha$ and $B_m = 0$ for $m \neq 1$. From (9) and (10) we obtain

$$\mu_o\, \alpha = A_1(1 + \mu_o)$$

In reference (1) it was shown that $A_1 = C_L S/\pi b^2 = \mu_o \alpha_e$ Then the effective angle of attack is

$\alpha_e = \alpha/(1 + 2S/b^2)$

Another example is afforded by the rectangular wing whose $C$ coefficients are given by

$$C_k = 2/\pi \int_o^\pi (\sin\theta/\mu) \cos k\theta \, d\theta$$

$$= -4/\pi\mu(k^2 - 1)$$

$$C_o = 1/\pi \int_o^\pi (\sin\theta/\mu)(d\theta) = 2/\pi\mu$$

The angle coefficients, for uniform angle of attack are the same as for the elliptical wing, i.e., $B_1 = \alpha$ and $B_m = 0$ if $m \neq 1$. Values of $(A_1/\mu\alpha, A_3/\mu\alpha, A_5/\mu\alpha$ and $A_7/\mu\alpha)$ have been computed for the rectangular monoplane of aspect ratio $= 2\pi$ by means of (9), which gives the first approximation to each coefficient $A_m$. These values are given in Table I, in which, for comparison, there are also tabulated the values for the same constants obtained from four simultaneous equations satisfying the fundamental formula (1) at the angles $22\frac{1}{2}°$, 45°, $67\frac{1}{2}°$ and 90°.

TABLE I: Rectangular Wing

($\mu = 0.25$ or $b/c = 2\pi$)

| Method | $A_1/\mu\alpha$ | $A_3/\mu\alpha$ | $A_5/\mu\alpha$ | $A_7/\mu\alpha$ |
|---|---|---|---|---|
| Formula (8b) | .911 | .110 | .023 | .0047 |
| Simultaneous Equations | .928 | .115 | .023 | .0041 |

It will be noted that the first approximation to the $A$ coefficients given by (8b) is sufficiently accurate for practical use, except where extreme accuracy is required. Successively closer approximations can be obtained by inserting in (8b) the approximate values of $A_n$ obtained by means of (9), and then solving for the particular value of $A_m$ corresponding to $B_m$. This process may be systematized in such a manner as to reduce the labor of calculations considerably when the number of $A$ coefficients to be determined is large. J. Morris explains this method [5].

We have set up a relatively simple system of equations for the determination of the $A$ coefficients in terms of the $B$ and $C$ coefficients which enter into formulas for the geometrical angle of attack and wing chord. It will next be shown how the $B$ and $C$ coefficients may be determined (by harmonic analysis), when the chord and geometrical angle of attack cannot be expressed as integrable algebraic functions of $\theta$.

*(To be continued)*

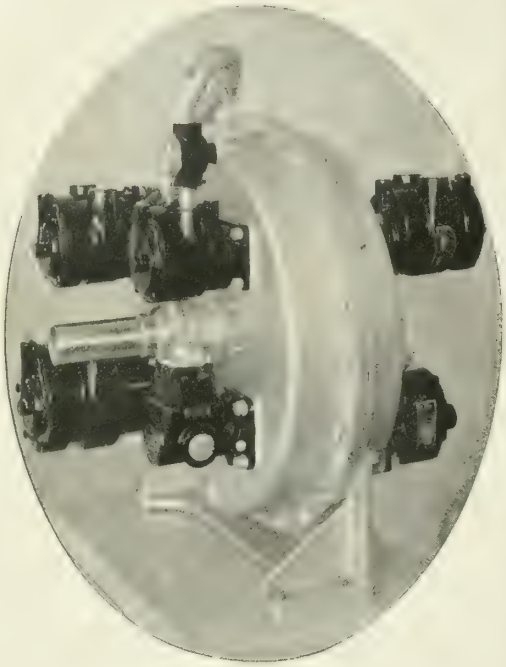
**Basic Symbols**

$A$ = circulation coefficient
$B$ = angle coefficient
$C$ = chord coefficient
$\alpha$ = geometrical angle of attack of wing
$a_o$ = slope of lift coefficient curve for infinite aspect ratio
$c$ = chord of wing at any point along span
$b$ = span of wing
$S$ = total wing area
$x = (-b/2)(\cos\theta)$ distance from any point on span to plane of symmetry of wing
Subscript, $o$, refers to center of wing

(5) J. Morris, *A Successive Approximation Process for Solving Simultaneous Linear Equations;* R. & M. No. 1711.



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# DIGEST OF FOREIGN ARTICLES

(*Continued from page* 66)

## Aerodynamics

*Tests of Six Aerofoil Sections at Various Reynolds Numbers in the Compressed Air Tunnel; E. F. Relf, A.R.C.Sc., R. Jones, M.A., D.Sc., and A. H. Bell. Air Ministry (Great Britain), Aeronautical Research Committee; R. and M., No.* 1706, *April* 1936

This report replaces R. & M. 1627, issued Sept. 1934. It presents the aerodynamic data for six airfoil sections, RAF 28, RAF 38, RAF 48, RAF 34, Clark Y H and Gottingen 387, which have been tested in the compressed air tunnel over a wide range of Reynolds number. The airfoils were of an aspect ratio of 6 with square tips, the span being 48″ and chord 8″.

Improvements in technique in the compressed air tunnel, and in particular the substitution of airfoil supports having less parasite drag than the wire suspensions first used have enabled a better determination to be made of the interference due to the supports. In addition, a small deviation of the wind direction from the horizontal has been revealed by later experiments. The chief differences occur in the drag of airfoil at high Reynolds numbers, where the previous errors due to wind direction and support interference happened to be additive, the drags as corrected are higher than those first published.

## Armament

*Aircraft Projectiles (Les Projectiles du Combat entre Avions; M. A. Brissot. Revue de l'Armée de l'Air; No.* 89, *Décember* 1936)

Stressing the point that all studies of aircraft armament must necessarily start with the analysis of projectiles employed, Mr. Brissot first describes various categories commonly used such as ordinary machine-gun bullets, incendiary explosives and fuse-type projectiles. He then analyzes the efficacy of projectiles and their ballistic qualities. The article concludes with the description of the different existing types, the types of gun with which they are used and a critical revue of their defensive and offensive value.

## Structures

*Calculations of Box Beams (Sur le Calcul des Poutres en Caisson; Dr. Leon Kirste. l'Aeronautique; No.* 212, *Janvier* 1937)

Introducing a new "displacement" factor, the author offers a simplified solution of box beams departing from the classical methods of elasticity. The new method makes it unnecessary to resort to the complex system of differential equations with their laborious solutions, resolving the entire problem by combining the unknowns into one easily determinable by a graphical construction. The method gives a determination of the elastic axis, torsonial and flexural deflection, and web and flange stresses. It will be interesting to see the comparative accuracy of the proposed method since its simplicity and expediency make it highly valuable for practical purposes.

## Flutter

*Design of Flutter-Proof Wings; E. P. Grossman, N. E. Joukowski's Central Aero-Hydrodynamical Institute, Technic of The Air Fleet; No.* 11, *November* 1936

The importance of the problem of flutter has been fully implanted in the minds of designers, particularly because of the steady increase in the maximum operating speeds of airplanes. Mr. Grossman points out that there are two fundamental ways of successfully solving the problem of safeguarding against flutter; increase in rigidity of wing structure retaining present types of design; and creation of new types of structure free from flutter trouble. Part of the paper is devoted to new semi-technical analyses of the nature and causes of flutter while part of it presents a mathematical treatment of the problem arrived at by the author. The physico-mathematical part gives only the results since this paper is shortly due to appear in full as a report of the Central Aero-Hydrodynamical Institute. The article is clearly and forcibly written.

## Structural Design

*Effect of Vibrations on Strength of Assemblies; V. D. Silvestrov Technic of the Air Fleet; No.* 12, *December* 1936

The author discusses a pertinent question regarding the effect of vibrations on aircraft structures. Pointing out the fact that the fatigue limit of material employed differs greatly from the "dynamic" resistance of the assembly the article advocates strength testing of aircraft structures under conditions of forced vibrations intended instead to simulate the actual flight conditions. It also suggests introducing into the structural design requirements, specifications regarding permissible unit stresses similar to present requirements relating to fittings, and also attachments subject to load reversals.

# DIGEST OF THE NEWS

## PRIVATE FLYING

### Club Activities

Twelve Denver (Colo.) women flyers, all of whom hold student pilot licenses, have formed a flying club to be known as the Wings. Officers are Gladys Howe; Letha Nell Bowman; Donna Tracy and Eileen Reavis. Chief purpose of the organization will be to encourage members to build up flying time to qualify for higher grade licenses.

* * *

With William E. Stinson as president and James I. McMartin as secretary, the Lockport (N. Y.) Aero Club has been organized with 25 members. It is a full-fledged New York State Aviation Association affiliate, according to Leslie F. Marsden, territorial manager for the state association.

* * *

Revised schedule of the Oklahoma City Aviation Club's 1937 air tour now includes 10 stops in five states, with the start set for June 9. The tour ships will leave Oklahoma City and make the following stops: Wichita Falls, night stop at Dallas, Tex.; McAlester, and Muskogee, Okla.; night stop at Fort Smith, Ark., Tulsa, Okla., Coffeyville, Kan.; night stop at Kansas City, Mo.; Wichita, Kan., and Bartlesville, night stop. The tour will finish June 13.

### Personnel Notes

Robert Bergesen, Kirk Baldwin, and Wilfred O'Leary have been appointed by Gov. Leslie Miller as members of Wyoming's newly-created state aeronautics commission, formed by the recent session of the state legislature. Commission members serve without pay except expenses while on official business.

### Air Show

Birmingham's 7th Annual National Air Carnival will be held Saturday and Sunday, June 5 and 6 this year. Steadham Acker, airport manager has been selected by the Birmingham Aero Club to act as general chairman.

Negotiations have already been started with several foreign countries to have their outstanding pilots perform.

Birmingham's National Air Carnival has grown in importance until it ranks among the major aviation meets of the country. It is staged free to the public, expenses being defrayed by voluntary local subscriptions. At the close of the 1936 show, after all expenses had been paid, $500 was placed in a special fund to start the 1937 event.

### Good Will Tour

A three- to four-month trip to Central and South American countries has been undertaken by Lieut. Howard F. Klein who is piloting a Canadian Grumman two-place fighter on a good will and sales demonstration tour. Frank Ambrose is accompanying Lieut. Klein as co-pilot and radio operator.

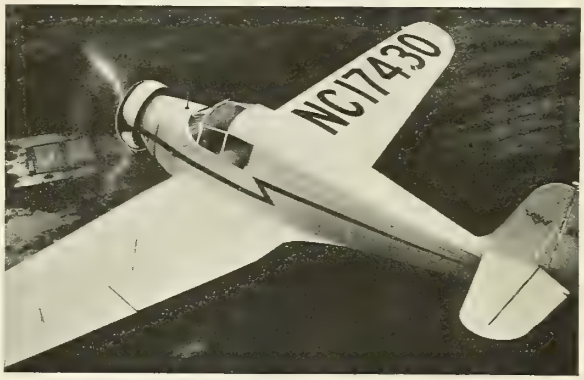
The plane is the standard U. S. Navy carrier type recently released for export by the U. S. Government. However, Canadian Car & Foundry Co., Ltd., licensee in Canada, have installed flaps which are not included in the regular Navy job. Power is supplied by a 750 hp Wright Cyclone equipped with a Hamilton Standard controllable pitch propeller. Included in the equipment being carried by Lieut. Klein is a two-

(*Continued on following page*)

*Canadian Grumman fighter powered by a 750 hp Wright Cyclone now being flown on a tour by Lt. Klein*




BIG SHIP *Performance* AT LIGHT PLANE COST!




● No plane in America can offer you all the advantages of the Warner-powered Low Wing Aeronca – at anywhere near its low price. It's in a class by itself.

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**You get:** The luxury and comfort of a roomy, completely enclosed, sound-deadened, upholstered cabin . a generously wide, side-by-side seat for pilot and passenger . excellent visibility in all directions . a roomy compartment with a 121-pound baggage allowance.

**You get:** The quick takeoff and slow landing speed, the stability, security, maneuverability and ease of flying that have long been recognized as outstanding characteristics of all Aeroncas.

**You get:** A smart-looking ship, whose external appearance reflects the high quality standards of its inner materials and construction.



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AERONAUTICAL CORPORATION OF AMERICA — AERONCA — Lunken Airport Cincinnati, O.

(*Continued from preceding page*)
way radio, the Coffman cartridge-type engine starter.

No speed records will be attempted during the trip, inasmuch as it is intended to give ample time to various government officials who desire to inspect and test the plane.

**Speed Course**

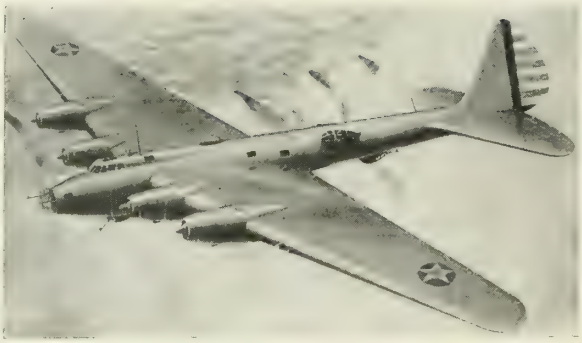
James Brazell, Oklahoma City sportsman pilot will sponsor, as a memorial to Wiley Post, an official airplane speed course with a home pylon at the Oklahoma City Municipal Airport. With this 32.8-mile course as a drawing card the Oklahoma City Aviation Club plans to sponsor a Wiley Post Aviation Air show of national scope in Oklahoma City this summer.

The speed course committee includes Jerry Sass, chairman, William Bleakley, Keith Kahle, and Herbert Howell. Work is to be started immediately on a movable steel pylon on the west end of the airport.

## AIR SERVICES

**Bomber Tested**

Initial tests on a new bomber, similar to, but larger than the YB-17 were made last month by Boeing Aircraft Co. at Seattle. Known as the YB-15, the new ship embodies further developments of the YB-17 four-engined bomber.



*Artist's perspective of the newest Boeing YB-15 Bomber, a larger version of the YB-17*

Structure of the new craft is all-metal, with a monocoque fuselage and a mid-wing. Power will be supplied by four 1000 hp P & W twin-row Wasp engines. Larger in span and heavier than the YB-17, the YB-15 will have complete living accommodations for the crew, including sleeping quarters, work room, lavatory, kitchenette; also provision for a 5-lens aerial camera, and a 110 volt alternating current primary electrical system.

**New Field Sites**

Aerial surveys by officers from Sixth Corps Area headquarters has resulted in the selection of Fox field as site of the new landing field to be established at Camp Custer, near Battle Creek, Mich

Since only $17,500 has been appropriated, the work will for the present be confined to levelling and grading the terrain and installation of runways. With lighting facilities, water, heat, hangars, and other airport equipment, not included in the project until further appropriation has been obtained, Corps Area officials plan to utilize Kellogg airport for night flying by army planes in the area.

* * *

Reeves Field on Terminal Island, Los Angeles Harbor, is nearing completion. Space for the repair of Navy planes has been concreted and virtually completed; the mole to provide areas for landing of sea planes has been finished and the ram is nearing completion. This field now has two runways, completely paved, each 4000 ft. long.

* * *

In preparation for the establishment of a $4,000,000 Air Corps technical school in Denver, taxpayers of the Colorado city have voted a $750,000 bond issue to buy a site on the outskirts of the city, some adjoining land and a bombing field nearby. The bonds will be issued just as soon as Congress appropriates the funds necessary to build, equip and start the school.

Options have been taken on most of the property to be included in the project. A section of land will be devoted to the project, it is understood, and money will be donated by the city to pay for the extension of railroad tracks to the school site and other necessary expenses.



### Fourth YB-17

Another plane, the fourth, was added to the U. S. Army Air Corps' growing fleet of Boeing Bombers when a crew of Army pilots left Seattle March 28 with the latest of this type.

With Maj. B. M. Giles of Langley Field, Va., in command of a crew of six, the Boeing YB-17, as in the case of the last two planes delivered, made its first stop at March Field, Calif., cruising the 1100 miles in 5 hrs. 13 min. Illustrating the mobility of this four-engined (1000 hp Cyclones) type of aerial defense weapon, the third of the YB-17's averaged 235 mph on its routine flight recently from March Field to Barksdale Field, a distance of approximately 1500 miles.

### Army Maneuvers

Virtually the entire GHQ is mobilizing in California for a month of maneuvers starting May 1. Approximately 3000 officers and 244 aircraft are participating under the command of Maj. Gen. Frank Andrews, GHQ chief.

Planes are being based at March and Hamilton Fields and various municipal and commercial airports, and daily maneuvers involving actual offensive and defensive battle practice will be held during the tests.

### Plane Bids Opened

Bids for contracts to supply the Army Air Corps with pursuit planes were opened at Wright Field on April 2.

Low bidder was Seversky Aircraft Corp. which quoted $18,500 each, exclusive of engines, in lots of 25, or $15,900 in lots of 250. The Curtiss Aeroplane Div. of the Curtiss-Wright Corp. offered planes at $41,630 each in lots of 25, and $18,720 each if 250 were ordered.

### Reserve Unit

A new Air Corps Reserve Unit, the 328th Observation Squadron, composed of San Antonio, Tex. Air Corps Reserve Officers was recently organized with Lieut. Col. J. H. Lapham in command. Maj. Winfield S. Hamlin is instructing the new squadron which has been assigned three trainers at Brooks Field.

### Control Tower

A traffic control tower is being constructed at Bolling Field. It will be located on the west end of the engineering hangar roof, the location affording a clear view of the field and facilitating control of planes from all directions. Sufficient radio receivers and other equipment will be installed for all required frequencies.

## SCHOOLS

### New Courses

A course in airway navigation has been started at Stewart Technical School, New York. It deals with the methods of navigating the air routes of the United States, and the application of radio, especially the new radio navigational aids now being installed along the airways, is explained in detail. Dead reckoning procedure when off the airways is also taught.

Commander P. V. H. Weems, U.S.N. Ret., is in charge. Classes meet every Thursday evening for a term of nine weeks.

* * *

Announcement of a new school to be known as the Air Cadet Corps of California has been made by J. Kegerreis, general manager. Plans call for a restriction in ages from 17-21. Offices are at 201-3 Hollywood-Western Bldg., Hollywood.

### Students From Abroad

Among new students at Curtiss-Wright Technical Institute of Aeronautics, Glendale, was one from Norway and another from Holland. Rolf Kjode, the Norwegian, has enrolled for an engineering course, as did Henri A. Gipberti Hodenpigl, son of a Lt. Colonel in the Dutch Royal Guard.

### Personnel Changes

Edmund R. Ryder recently resigned as inspector in the aeronautical engineering department of the University of Washington to accept a position with the Boeing School of Aeronautics.

* * *

Rising Sun Aircraft School, Philadelphia, announced the appointment to its faculty of Lieut. Warren G. Nichols formerly with Seversky Aircraft Corp.

### More Equipment

Parks Air College has purchased a four-place Stinson *Reliant* which will be added to its flight line, bringing the total number of student training ships to 13. The Stinson will be equipped with a complete set of flight instruments for instruction in instrument flying.

## AIRPORTS

### Improvements

Corpus Christi, Tex., municipal airport. Drainage, two 3000-ft. runways, installation of radio directional equipment; $60,000.

(*Continued on following page*)


Corona* IMPAIRS

SPARK PLUG PERFORMANCE

Every good pilot inspects the vital parts of his ship before each flight. Every strut and stay, every instrument, every part of the engine is subjected to the closest scrutiny at regular intervals. Yet 9 out of 10 pilots fail to catch that ever-growing menace —corona in spark plugs. . . Corona has been an ever-present danger in all mica aircraft spark plugs for a good many years and very often appears even in brand new ones. Champion Nocorona Mica Aircraft Spark Plugs, positively eliminate corona. Hard starting and missing, fouling and rough idling caused by corona, become things of the past and engine performance improves tremendously. . . Install a set of Champion Nocorona Spark Plugs in your engine. You can always depend on Champions.

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(*Continued from preceding page*)

WPA and city project.

Memphis, Tenn., municipal airport. Extension of city water main to field; $5600. City project.

Sherman, Tex., municipal airport. New runways, sodding field, rebuilding road. WPA and city project.

Texarkana, Ark., municipal airport. Lighting system, leveling field, new hangar, widening runways, installation of radio beacon, removal of obstructions, new administration building, $39,400. WPA and city project.

Tulsa, Okla., municipal airport. Extension of N-S runway, construction of new asphalt runway, installation of traffic control lighting system.

Milwaukee, Wis., Maitland Field. New hangar, 40′ × 60′; office building. $10,000.

Appleton, Wis., Outagamie County Airport. New hangar, 100′ × 100′; $25,000.

Seattle, Wash., Boeing Field. Removal of obstruction (smoke stacks); grading and surfacing new 8000-ft. runway.

Portsmouth, Ohio, Rock Haven Airport. Enlarging hangar to 50′ × 80′ and installing concrete floor. $4500.

Basking Ridge, N. J., Somerset Hills Airport. Extension of E-W runway by 400 ft.; new hangar.

San Francisco, Calif., municipal airport. Completion of earth fill for seaplane base; reclamation of 103 acres for extension to east; leveling and drainage of 330 acre emergency landing area adjacent; radio control house; paving and landscaping; installation of automatic control at drainage pump house; removal of obstructions (power poles). $1,300,000 WPA and city project.

### Personnel Notes

Robert C. Helfrich and Wilfred M. Post have taken over the management and operation of the Allentown-Bethlehem Airport, Allentown, Pa., under the name of the Lehigh Aircraft Co.

### Field Purchased

Consolidated Airport, Knoche and Military Roads, Tonawanda, N. Y., was purchased recently by Bell Aircraft Corp., Lawrence D. Bell, president, for $125,000.

Present occupants are Argonaut Aircraft Corp., and Phil's Flying Service, operated by Philip Miraglia.

## AIRLINES

### Schedule Changes

Eastern Air Lines' *Pan American Express* which leaves daily from Newark Airport at 1:40 pm will now fly the 989 miles between Washington and Miami non-stop. The flight formerly operated as a one-stop schedule with a refueling halt at Charleston.

* * *

Wyoming Air Service is planning to extend its northern terminus from Billings to Great Falls, Mont., in an effort to secure the air mail contract for the Montana route for which $51,000 of the recent $537,000 appropriation was earmarked by Congress for air mail extensions.

* * *

Virtual overnight service between New York and Mexico City via Dallas has been arranged by Braniff Airways, through hook-ups at one end of the line with United Air Lines and with Pan American Airways at the other. Leaving New York at 4:30 pm by United, passengers transfer to Braniff at Chicago, reach San Antonio at 6:10 am, and Brownsville at 8:10 am, where another transfer, to a Pan American plane is made bringing the passenger in Mexico City in time for lunch.

* * *

Daily passenger service between Floyd Bennett Field and Boston was inaugurated by American Airlines, Inc., the service marking the first use of the New York airport as a terminal for passenger planes. Schedules call for two planes each way daily.

* * *

A new schedule cutting 40 minutes from travel time between New York City and Oklahoma City was put into effect by Braniff Airways and United Air Lines. Under the revision, passengers leave New York at 5:10 pm on United's Douglas Sky Lounge, connect at Chicago with a Braniff ship and arrive in Oklahoma City at 2:50 am, making this the fastest New York-Oklahoma City schedule available according to Braniff officials.

### More Equipment

Eight new Lockheed S-14 transport planes have been purchased by Northwest Airlines, Inc., at an expenditure of nearly $1,000,000. The fleet now is under construction and delivery of the first plane in St. Paul is scheduled for early summer.

The S-14, which will carry ten passengers in addition to a crew of three, will be powered by two 850 hp Wright Cyclone engines.

* * *

Transcontinental & Western Air, Inc., has sold five of its 14-passenger Douglas Skyliners to Braniff Airways, delivery to be made when TWA receives their new 25-passenger Douglas Sleeper Skyliners.

* * *

Avery Black, president of Varney Air Transport, Inc., has purchased for his company a fleet of

all-metal P & W Wasp-powered Lockheed 12 airplanes to be placed in service over AM-29, between El Paso, Texas and Pueblo, Colorado, via Albuquerque, Santa Fe, Las Vegas, New Mexico, and Trinidad, Colorado.

### 58,008 Passengers

The 19 scheduled air lines operating in continental United States in February, 1937 carried 58,008 passengers during that month, according to the Bureau of Air Commerce.

These lines flew 4,599,714 miles, carried 500,004 pounds of express, and flew 26,107,787 passenger miles.

A comparison with January, 1937 and with February. 1936, shows that passenger traffic increased by 11,996 and 16,458 respectively.

* * *

Traffic on American Airlines, Inc., established a new record for March when passenger revenue increased 44% over March 1936 and 34% over February 1937. In addition, the company carried 20,366 revenue passengers, the first time in its history that 20,000 revenue passengers were carried in the month of March of any year. This compares with 15,843 revenue passengers transported in March, 1936, and 15,929 in February, 1937.

* * *

First three months passenger and revenue report of Chicago and Southern Air Lines shows, according to Carleton Putnum, president, the number of passengers carried between Chicago and New Orleans to have exceeded by 97% those transported during the same period last year. Passenger revenues show an increase of 184% for the quarter.

* * *

March traffic over Eastern Air Lines bettered all previous records for revenue passenger miles flown, revenue passengers carried, and revenue miles flown, Capt. E. V. Rickenbacker, general manager, announced. Measured against March, 1936, the previous record month, March, 1937, saw its largest increase in revenue passengers carried, a gain of 35%. Next was revenue passenger miles flown with a 24.5% increase.

### Personnel Notes

New manager of Northwest Airlines' air express division is Fred R. Erickson, formerly with Railway Express Agency.

* * *

American Airlines elevated Edward G. Bern to national publicity director from west coast publicity representative, that job now being handled by Carl Anderson, former sales representative at Cincinnati.

* * *

Operations Manager L. H. Luckley of Braniff Airways has a new assistant, Reagan C. Stunkel who will be in charge of maintenance.

* * *

Eastern Air Lines promotions came to Walter Sternberg, now Chicago district traffic manager; to Pres Tolman, now DTM at Jacksonville, and to Gregory Flynn, now in New York. Another promotion, to chief navigation engineer, was given to H. S. Huntington.

* * *

Charles Knecht, sales representative of Delta Air Lines, has been transferred to the Dallas office as traffic representative.

* * *

Western Air Express' new chief pilot is Fred Kelly, million-miler with the company since 1926.

### New Services

Resumption of regular service into Chattanooga by Eastern Air Lines was undertaken April 15, with southbound planes from Chicago now stopping at 11:30 pm daily to pick up passengers for Atlanta, Jacksonville, Miami, and other southern points. Northbound planes from these points stop at Chattanooga at 1:20 am daily.

* * *

Effective April 1, a 7:30 am flight from Detroit to Chicago, via American Airlines, with a stop at South Bend, Ind., was inaugurated. The flight is intended primarily to give Detroiters a full business day in Chicago, and also to make a connection with a plane leaving for southwestern points and Los Angeles. Also on that date, the company started making stops at Jackson, Mich.

* * *

New 90-minute passenger and express service between Pittsburgh and Charleston, W. Va., via Parkersburg, was inaugurated by Pennsylvania-Central Airlines. One round-trip daily is flown with a stop being made at Parkersburg.

### Ocean Service

As the result of negotiations with Canada, the final diplomatic obstacle to joint operation of a transatlantic airline by British and American companies has been removed.

A final proposal in connection with the location of terminals on this side of the Atlantic had been approved by the Canadians and an agreement has been reached by Canada, the United States and Great Britain which provides for reciprocal operation of aircraft involved over their respective territories as well as the reciprocal use of terminals, with New York the western terminus.

Bids will soon be considered by

(*Continued on following page*)


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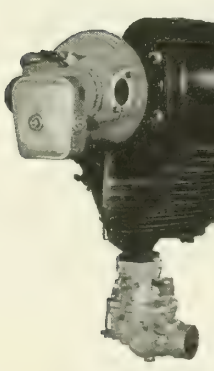
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*The 950 hp P & W-powered Bellanca 28-90 Flash, twenty of which have been ordered by Air France for mail transport*

(*Continued from preceding page*) the Post Office Department for the transport of mail over the Atlantic, and, as a final preliminary to a service which calls for four transoceanic flights a week, the first test flights will be made.

The plan provides for an alternate transatlantic service in the Winter months by way of Bermuda and the Azores. Pan American Airways and Imperial Airways have obtained a concession for the next 25 years from Portugal for stations in the Azores and at Lisbon.

Both Imperial and Pan American plan to use this route in certain seasons until equipment has been perfected for all-weather sub-stratosphere flying over the northern route.

### New Fares

Elimination of winter rates and establishment of reduced summer fares over its coast-to-coast system by Transcontinental & Western Air, Inc., goes into effect May 1. TWA also announced that charges for meal service would be eliminated with the introduction of the new fares.

The summer fares are substantially below those in effect last summer over the TWA system.

Another innovation is the creation of a fare scale of three distinct classes. These will be governed by the degree of luxury demanded by the traveler and will be in keeping with the three classes of service to be offered by TWA through the introduction of its new flying equipment.

With the advent of the company's new 25-passenger Sleeper Skyliners, berths comparable to those offered on railroad Pullmans will be available. This will be a full de luxe form of transportation for which TWA will make an extra charge. Another degree of luxury aboard the same planes will be nine divan chairs with adjustable chaise lounge attachments. This will constitute a parlor car service and amount to the second stage of luxury in air travel with TWA. Still another will be made available to its passengers by TWA through the introduction of its new 21-passenger Club Skyliners.

The new TWA summer fares will be figured on the basis of .057 cents per mile for the coast-to-coast journey as against last summer's rate of .061 cents. The additional cost of a berth on TWA's Sleeper Skyliners will range from $3.00 to $8.00, depending upon the distance traveled. Similarly there will be a small extra charge for divan lounge chairs. Figured in accordance with the new summer fares, the cost of flying from coast to coast aboard TWA planes will be $149.95, while last summer's rate was $160.00.

### Sales Offices Moved

American Airlines, Inc. has moved its general sales, sales promotion and publicity offices from its base at the Chicago Municipal Airport to 20 North Wacker Drive, Chicago. Expansion of services and increases in business necessitated the transfer.

### Freight Line

Scheduled air freight service is offered by Coastal Air Freight, Inc., of Glendale, Calif., which is operating a three-hour service between Los Angeles and San Francisco twice daily with stops at Fresno and Bakersfield when shipments require it. The company is using Fokker, Travel Air, Hamilton and Stearman planes especially adopted to carry freight.

Planes leave both cities on a regular schedule, but spare planes are available for special work.

### Air Mail Route Sale

Stockholders of Wyoming Air Service, Inc. have voted to accept United Air Lines offer to purchase the Denver-Cheyenne leg of the air mail route operated by the Wyoming company, subject to governmental approval.

Marvin W. Landis, vice-president of the Wyoming concern, said his company's objections to the proposed diversion to Denver of one east and west bound plane daily from the transcontinental route through Cheyenne would be withdrawn. The proposal of diversion is pending now before the Post Office department. Points of diversion would be North Platte, Neb., and Laramie, Wyo.



*Part of the Barkley-Grow factory in Detroit where "Supreme" propellers and the T8P-1 transport are being manufactured*

Wyoming will continue passenger and air express service between Cheyenne and Denver, and daily mail, passenger and express service between Cheyenne and Billings, Mont.

### Safety Awards

Recognition of outstanding contributions to safe air transportation was accorded three airlines by the National Safety Council during its meeting in New York last month. Known as the First Aviation Safety Awards, certificates were presented to Eastern Air Lines, Pennsylvania-Central Airlines and Northwest Airways.

Group A award, for domestic lines operating more than 50,000,000 miles yearly, went to Eastern for its record (including its predecessor) of 141,794,894 miles without a passenger fatality.

Group B award, for domestic lines operating less than 50,000,000 miles annually, went to Northwest. Its record shows 48,768,411 passenger miles without a passenger fatality in ten years.

A special award was given to Pennsylvania-Central for having operated, through its component companies, from 1930 to 1936 without either a passenger or crew fatality, covering a total of 36,177,210 passenger miles.

## INDUSTRY

### Schroeder Resigns

Resignation of Maj. R. W. (Shorty) Schroeder as first assistant to Director Fred Fagg of the Bureau of Air Commerce was announced by Col. J. Monroe Johnson, assistant secretary of Commerce in charge of aeronautics.

Schroeder will become vice-president in charge of operations of United Air Lines, assuming the position occupied by D. B. Colyer whose elevation as assistant to President W. A. Patterson, left the vacancy which Schroeder fills.

### Plant Expansion

Addition will be made to the Taylorcraft Aviation Co. plant north of Alliance, Ohio, according to company officials. A fireproof, one-story addition is to be added to the east side of the present building and a two-story addition in front, providing 50% more floor space.

* * *

Welch Aircraft Industries, Inc., South Bend, Ind., have again increased their manufacturing space and now have available several thousand feet of floor space. This company is now in production on three models — OW5M Continental A40-4 powered, OW6M Aeronca-powered, and OW7M, Welch-powered.

* * *

Expenditure of approximately $1,350,000 will be made for three additions to the factory of the Wright Aeronautical Corp., and purchase of $500,000 worth of new machine tool equipment. Included in the program are a new four-story factory wing for which the ground is already being excavated, an enlargement of the assembly department and the addition of two units to the new testing laboratories. When completed, these buildings will add about 80,000 sq. ft. of floor space to the factory, making available a total of almost 800,000 sq. ft.

### Newly-approved Types

Cessna, C37; 4-place cabin monoplane. 145 hp Warner Super Scarab. (622)

Sikorsky, S-43W; 19-place cabin amphibion. 760 hp (2) Wright Cyclone SGR-1820F-52's. (623)

Stinson, SR-9D and SR-9E; 5-place cabin monoplane. 285 hp Wright R760E-1, or 320 hp Wright R760E-2, respectively. (625)

Waco, YGC-7 and ZGC-7; 5-place cabin biplane. 225 hp Jacobs L-4 or 285 hp Jacobs L-5, respectively. (627)

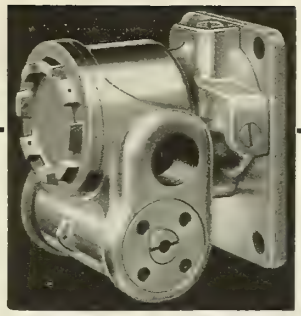
Spartan, 7W; 4-place cabin monoplane. 400 hp P&W Wasp Jr. SB. (628)

Curtiss-Wright, A-19-R; 2-place cabin monoplane. 420 hp Wright R-975E-3. (629)

### Deliveries Increased

Aircraft and aircraft engine manufacturers of the U. S. increased deliveries last January by

(*Continued on following page*)

UNFAILING PERFORMANCE
EVANS *Aircraft* FUEL PUMPS

**The day of spectacular recklessness in aviation is gone. Today's pilots are conservative men with sound judgment. They know that no engine is any more reliable than its fuel pump. That is why EVANS *Aircraft* FUEL PUMPS have earned their wholehearted approval. They can depend on Evans Pumps for unfailing performance.**

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$1,495 — $3,130

THE SMART AIRPLANE FOR SMART PEOPLE

(*Continued from preceding page*)

62% over the same month in 1936, according to the Aeronautical Chamber of Commerce of America. The report shows an increase of 232% in the dollar value of commercial airplanes delivered in January, 1937, as compared to January, 1936.

Deliveries of aircraft and aircraft engines and spare parts totaled $5,618,978. Deliveries of commercial aircraft totaled 102 units valued at $1,109,397 as compared to 37 units valued at $333,703 for January, 1936. In January, 1937, there were delivered 167 commercial engines valued at $598,781.

### Business Reports

Substantial improvement in earnings and the largest backlog of unfilled orders in the company's history were reported by the Boeing Airplane Co. in its annual statement. Unfilled orders totaled $8,921,797.22 on December 31, 1936, and orders received during January and February of 1937 amounting to an additional $2,655,147.83. Total unfilled orders on December 31, 1935, was $6,141,203.23. Consolidated net profit for 1936, after federal normal income tax and surtax, was $168,364.35. This compares with a loss of $333,799.62 for 1935.

## DIGEST OF RECENT EVENTS

**First Non-Stop Flight Made Between Lima and Buenos Aires**

Commander Armando Revoredo Iglesias of the Peru Air Force made the first non-stop solo flight between Lima and Buenos Aires, flying the 2000 miles, part of it over the Andes, in 13 hrs. 51 min. MARCH 27

**Clipper Ship Completes New Zealand Survey Flight**

With the successful completion of the Pago Pago-Auckland flight of 1800 miles, the Pan American Clipper finished a 7000-mile survey flight from San Francisco. The flight was commanded by Capt. Edwin C. Music and was made to survey a new aerial trade route from the U. S. to Australia. MARCH 30

**Speed Records Set by Nicolet in Breda 88**

New speed records over 100- and 1000-kilometer courses were set at Montecelio near Rome by Furio Nicolet who flew a stock model Italian Air Force all-metal twin-engined Breda 88 pursuit-bomber at an average speed of 323.647 mph (517.836 kph) to break Mauriuce Arnoux old mark of 297.697 mph (41.520 kph) over a 100-kilometer course. Over the 1000-kilometer course, Nicolet averaged 302 mph (484 kph) also wresting from Arnoux, by 20 mph, the speed record in this category. APRIL 9

**Japanese Pilots Set Tokyo-London Record**

Breaking existing records by almost two days, Masaaki Iinuma and Kenji Tsukagoshi flew an all-metal low-wing Mitsubishi monoplane powered by a 550 hp Kotobuki engine from Tokyo to London in an elapsed time of 94 hrs. 18 min. The distance is approximately 9900 miles, and the flight was completed at an average speed of 198 mph. The old record was set about 10 years ago by Coste and Lebrix. APRIL 9

**Merrill Sets Airline Mark For Newark-Miami Run**

Dick Merrill, of Eastern Air Lines, set a commercial plane record of 5 hrs. 26 min. flying time for the run from Newark Airport to Miami, Fla., covering the 1192 miles at approximately 222 mph in a Wright Cyclone powered Douglas DC-3. The former record was 5 hrs. 39 min. established by Don Johnston, also an Eastern Air Lines pilot. Merrill made a scheduled stop, at Charleston, S. C., for refueling, bringing his elapsed time to 6 hrs. 6 minutes. APRIL 12

**PBY-1 Navy Boats Make Trans-Pacific Flight**

The third mass flight of a squadron of P & W powered Consolidated PBY-1 Flying Boats for the U. S. Navy was completed when 12 ships carrying 78 men landed at Honolulu after a 2553-mile non-stop flight from San Diego. Under command of Lieut. Cmdr. L. A. Pope the ships flew in formation to negotiate the distance in 21 hrs. 25 min., being held back about an hour by inclement weather near Honolulu. APRIL 13

*Landing of the Mitsubishi monoplane at Croydon after a 94-hour flight of 9900 miles from Tokyo*

*Acme photo*



Advance orders for 46 Ryan S-Ts representing a backlog greater than the entire 1936 production forecasts one of the busiest years in the history of the Ryan Aeronautical Co., according to Earl D. Prudden, vice-president. To accommodate demand for these planes the company is completing plans to again expand manufacturing facilities from its present 10 plane per month capacity to a 30 plane per month basis. Additional drop hammers are being installed immediately to fabricate formed parts all of which Ryan now manufactures by this process.

* * *

Net profit of $50,697 on a gross revenue of $740,984.00, was reported by Western Air Express in the yearly statement for 1936. In comparison, 1935 operations resulted in a net loss of $8188 on a gross revenue of $586,988.

Passenger revenue in 1936 was $363,554.87 or 34.97% gain. Air mail revenue was up to $330,198 or 13.95% increase. Air express showed a gain of 95.61% and produced a revenue of $37,038.

* * *

Since formation of Taylorcraft Aviation Corp. on December 18, 1936, it has received 266 orders for the standard Model A, according to C. G. Taylor, president.

**Personnel Notes**

Raymond W. Young, assistant engineer, Wright Aeronautical Corp., has been awarded the 1936 Manly Memorial Medal for his paper *Air-Cooled Radial Aircraft-Engine Performance Possibilities,* presented before the SAE.

* * *

John Livingston has given up his position as engineering test pilot for Waco Aircraft Co., and will return to Waterloo, Ia., to resume active charge of Livingston Airways, Inc. Present plans include continuation and expanding of the sales program of Livingston Airways including the handling of Waco's and Cubs.

* * *

Joe Shumate, member of the Washington office of the Bureau of Air Commerce, has replaced C. A. Rowe as bureau supervisor for the Oklahoma area.

Ray R. Brockett has been elected secretary of Irving Air Chute Co.

* * *

O. J. Whitney, president of O. J. Whitney, Inc., has just returned from his annual flying visit to Central and South America. He flew a standard model C-17B Beechcraft, powered by a 285 hp Jacobs engine, and visited 14 countries.

* * *

Howard Hughes will act as aeronautical adviser to the New York World's Fair of 1939.

* * *

Douglas Robinson has rejoined Kellett Autogiro Corp. after an absence of several years in the aviation insurance business in New York. He will devote his activities to autogiro sales.

* * *

John M. Tyler has joined the staff of the Hamilton Standard Propellers division of United Aircraft Corp. to specialize in the fields of stress measurement and vibration problems.

**7629 Aircraft**

There were 15,865 pilots and 7629 aircraft holding active Department of Commerce licenses on April 1, 1937, according to the Bureau of Air Commerce. On April 1, 1936, there were 14,806 licensed pilots and 7205 licensed aircraft.

Total number of aircraft, licensed and unlicensed, of which the Department had record on April 1, 1937, was 9326, while this number on the corresponding day of last year was 8887. Unlicensed aircraft (bearing identification numbers only) totaled 1697 on the first of April, 1937.

Among the 15,865 persons holding pilots' licenses as of April 1, 1937, were 7178 transport, 860 limited commercial, 7144 private and 683 amateur.

**Foreign Sales**

Delivery of a fleet of six *Electra* transports to Polish Air Lines (LOT) is now under way, the first having been taken last month and the balance due this month.

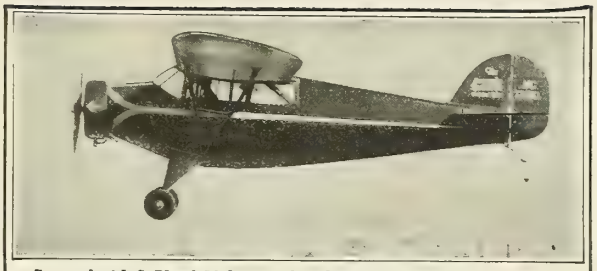
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Export sales of Rearwin *Sportsters* during February in-

(*Continued on following page*)

*Latest Cessna C37 "Flag Ship" which is powered by a 145 hp Warner Super Scarab*



*Powered with LeBlond 70 h. p. and 90 h. p. and Warner 90 h. p. motors*

**MORE REARWINS SOLD in 1936 than ANY OTHER MAKE in same price range**

A few excellent territories for REARWIN AIRPLANES are still open. Make money and friends for yourself by selling REARWINS. Write or wire — TODAY—for further information.

REARWINS were FIRST in domestic sales in the $1800-$5000 bracket, according to production figures compiled and released by the Bureau of Air Commerce. These figures further reveal that

REARWIN'S DOMESTIC SALES WERE 60% GREATER THAN OUR NEAREST COMPETITOR'S

These Bureau of Air Commerce figures cover only domestic sales. Rearwin's 1936 export sales absorbed 26% of our entire 1936 output.

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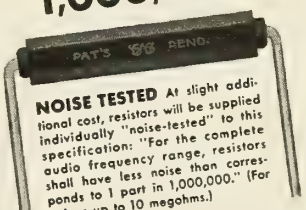
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**ATLANTIC CITY**


(*Continued from preceding page*) cluded two in South Africa and six in Australia, the latter purchase being made by Holyman's Airways, Melbourne.

* * *

The Kingdom of Siam has ordered a number of Martin Bombers, the contract amounting to $625,000. The airplanes are the standard Martin type and will be used in the modernization of the equipment of the Siamese Air Force.

* * *

Fifteen aircraft engines to be used in navy training planes have been ordered by the Dutch navy from Menasco Manufacturing Co. Engines are of the B6 model rated at 160 hp.

### New Corporations

Bendix Aviation Export Corp., New York, N. Y. Howard S. Welch, vice-president; control of export sales of Bendix products in automotive, aeronautical, industrial and radio divisions of Bendix Aviation Corp.

Aerial Ambulance & Charter Service, Los Angeles, Calif., E. A. Moore, president.

Stout Aircraft Co., Ashtabula, O., capital $25,000. Incorporators, R. L. Stout, E. P. Stout, A. D. Ringer.

Akron Aircraft, Inc., Akron, Ohio. Capitalization $52,400. Incorporators H. C. Funk, E. Foore, J. C. Funk.

Mouton & Clyde, Inc., San Francisco Airport. Directors Fred Spreckles, William Clyde, Gibbons Meyer, E. E. Mouton.

### Dealers

Huntington & Ross, Inc., Grand Central Air Terminal, Glendale, Calif., distributors for Arrow *Sport* in California.

### January Exports

American aeronautical manufacturers shipped $2,216,506 worth of their products to foreign countries and foreign possessions during January, 1937. This compares with $1,091,350 for the same month the previous year.

Exports consisted principally of 47 aircraft valued at $1,413,471; 45 engines, worth $191,080 and $611,955 worth of parts, accessories and parachutes.

Most aircraft during the month were shipped to purchasers in Mexico, 16 valued at $283,650, but greatest dollar sales were to Spain which imported 8 planes worth $325,000. Six engines, with a total value of $69,000 were shipped to Japan while Canada imported 10 at $17,795. China also imported the most parts and accessories during January, spending $147.067 for American products in this category.

### Order for Floats

An order for 25 sets of seaplane floats was placed with Edo Aircraft Corp. by Taylor Aircraft Co., the largest commercial order ever placed with Edo.

# Coming Events

Summer Meeting, SAE; The Greenbrier, White Sulphur Springs, W. Va. May 4-9

•

Twelfth Annual Aircraft Engineering Conference. National Advisory Committee for Aeronautics, Langley Field, Va. May 20

•

Annual Air Show. Purdue University Airport, Lafayette, Ind. May 23.

•

Air Races. Lambert-St. Louis Airport. St. Louis Air Race Association. James R. Ewing, manager. May 29-31

•

First Salon International de Aeronautique Palais du Centaire, Belgium. Sponsored by Ministry of Transport and Belgium Aero Club. May 26-June 6

•

Seventh Annual National Air Carnival. Birmingham, Ala. Aero Club; Stedham Acker, general chairman. June 5-6

•

International Air Show. Special feature Chicago Centennial Jubilee. International Amphitheatre, Chicago. June 12-20

Air Meet. Findlay, Ohio, Municipal Airport. In conjunction Golden Celebration of Gas and Oil. June 23

•

Fifth Annual Air Show. Junior Chamber of Commerce. Marshall, Mich. Municipal Airport. June 26

•

International Glider Competition. Aero Club of Germany. Wasserkuppe. July 4-18

•

Air Show. North Dakota NAA. Ludvig Tweton, chairman show committee. Minot, N. D. July 8-9

•

Fourth International Aviation Meeting. Zurich, Switzerland. Aero Club of Switzerland. July 23-Aug. 1

•

National Air Races. Municipal Airport, Cleveland, Ohio. Cliff Henderson, managing director. Sept. 3-6

•

SAE National Aircraft Production Meeting. Los Angeles, Calif. Oct. 7-9

# Two-Seater Koolhoven FK-52

## General Purpose Fighter Built in Holland Has Top Speed of 250 mph



*Koolhoven FK-52 Fighter powered by a British Bristol "Mercury" engine of 830 hp*

● A two-seater biplane general purpose fighter, designated the FK-52 by its builders, the N. V. Koolhoven-Vliegtuigen of Rotterdam, Holland, has completed preliminary tests during which it demonstrated outstanding performances in speed, climb and maneuverability.

### Details of Construction

Construction is of combination wood and metal, the fuselage being of welded steel tubing covered with detachable three-ply panels on the sides and a detachable rear portion of wood. Seats are arranged in tandem and are provided with a transparent canopy top of unbreakable transparent material. The rear portion of the roof is arranged to fold down and retract fully into the fuselage leaving an entirely unobstructed area for the rear machine gun. Both cockpits are equipped with bomb release gear and the pilot's cockpit is provided with control of two machine guns in the wings. The rear cockpit has a machine gun support and openings in the floor for aerial photography. Instruments provided include airspeed indicator (2), altimeter (4), turn indicator, bank indicator, tachometer, oil pressure gauge, rate of climb indicator, Sperry gyro-horizon, oil thermometer, manifold pressure gauge, fuel quantity indicator, fuel pressure gauge, ampere meter, voltmeter, clock (2), compass (2), and boost gauge.

Wings are all-wood construction utilizing two box spars with 3-ply plywood ribs, the whole being covered with 3-ply plywood. Ailerons, provided on the lower surfaces only, are of duralumin.

Wood monocoque construction has been utilized in the tail unit, the fin being an integral part of the rear portion of the fuselage. Elevators and rudder are of duralumin, and are equipped with trimming tabs adjustable in flight.

### Landing Gear and Engine

The undercarriage is of the full cantilever type, equipped with brakes and streamline wheels and tires. The tail wheel is fully swivelling.

Power is supplied by an 830 hp Bristol *Mercury* engine mounted on a unit of welded steel tubing.

An electric starter and 3-bladed adjustable pitch propeller are also provided.

Specifications and performance figures of the FK-52 with the 830 hp Bristol *Mercury* are as follows (maximum speed is at 4000 m., or 13,120 ft., and cruising speed at 3800 m., or 12,467 feet).

| | (*English*) | (*Metric*) |
|---|---|---|
| Wing span | 32′ 1″ | 9.8 m |
| Overall length | 27′ 5″ | 8.35 m |
| Overall height | 10′ 9″ | 3.3 m |
| Wing area | 305.6 ft.² | 28.4 m² |
| Power loading | 5.9 lbs./hp | 2.71 kg./hp |
| Wing loading | 15.3 lbs./ft.² | 79.3 kg. |
| Empty weight | 2976 lbs. | 1350 kg. |
| Useful load | 1984 lbs. | 900 kg. |
| Gross weight | 4960 lbs. | 2250 kg. |
| Maximum speed | 230 mph | 370 kph |
| Cruising speed | 208 mph | 335 kph |
| Landing speed | 67.7 mph | 109 kph |
| Rate of climb | 1673 ft./min. | 8.5 m/sec. |
| Service ceiling | 30,183 ft. | 9200 m |
| Cruising range | 652.5 mi. | 1050 km. |




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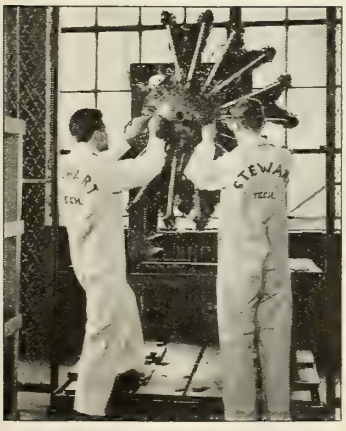
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- on the SIKORSKY S-43 Luxurious Transport Plane

SOLAR AIRCRAFT COMPANY

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# FOREIGN NEWS IN BRIEF

## Australasia

Australian commercial airways expect to fly more than 7,000,000 miles in 1937 against 1,500,000 five years ago. Regular routes now circumnavigate the coastline twice weekly, and the Brisbane to Melbourne line now operates twice daily each way.

Delivery of Avro *Ansons* for the Royal Australian Air Force is now preceeding, to be followed by 18 *Blenheims*. Commonwealth Aircraft Corp. promise delivery of the first NA-16 advanced trainers built in Australia before the end of the year.

Australian flying clubs will be subsidized for a further term. The establishment grant has been reduced from $1468 to $979 a year, provided at least two planes be maintained in serviceable condition; in addition, a special maintenance grant of $61 per 50 hours of flying with a maximum of $245 per year per plane is authorized. Bonus payments of $98 per pilot trained and $49 for each renewal of pilot's license are continued.

Airlines of Australia Ltd., will operate additional flights between Brisbane and Townsville permitting a service three times weekly between Townsville and Sydney in each direction. The Townsville-Cairns service will be co-ordinated with the Brisbane-Townsville service, and the company has decided to reopen the service between Townsville and Mt. Isa, which has been discontinued for some time.

Australian National Airways have ordered two additional Douglas airliners. With those Previously ordered, there will be six DC-2s in commission. The company also acquired a Junkers 86 Diesel-engined 10 passenger transport.

Guinea Airways Ltd., which previously confined its activities to New Guinea, has started a service weekly in each direction between Adelaide and Darwin which it is intended ultimately to link with the KLIM service when the latter is extended from Java to Darwin. The company also plans to inaugurate a direct Sydney-Adelaide service before June, with Lockheed *Electras*.

Additional importations of American planes new to Australia are a Beechcraft, for T. J. Masse, a Sydney manufacturer, and an Aeronca by G. B. S. Falkiner, of Warren, N. S. W. The Beechcraft is for private flying, and the Aeronca for student instruction.

Commonwealth Aircraft Corp., Pty., Ltd., will establish an aircraft factory at Fisherman's Bend, Port Melbourne. Survey work has been started preparatory to the erection of buildings on a site covering 30 acres and measuring 1980 × 660 ft. North American NA-16's will be built.

*Canadian-built Wasp-powered Noorduyn "Norseman"*




## Canada

To provide trans-continental air mail, express and passenger service which will connect with trans-atlantic air mail, Trans-Canada Air Line will be organized by the Dominion Government with capitalization of $5,000,000 divided into $100 shares and underwritten by the Canadian National Railway System.

**B★A★30** AIRPLANE WING CLOTH IS LIGHTER, STRONGER AND MORE CLOSELY WOVEN THAN OTHER AIRFOIL FABRICS. WRITE TO WELLINGTON SEARS COMPANY, 65 WORTH STREET, NEW YORK CITY, FOR SAMPLES AND PRICE LISTS.

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Gives you dual full-wheel controls . . . 39" side-by-side cabin . . . separate belts . . . high cruising speed . . . exceptional stability . . . at a LOW price

3rd annual



DIGEST OF AIRCRAFT & ENGINE MATERIALS
July 1937

If the principal buyers of your products are the chief engineers, purchasing agents and production managers of the aircraft and engine manufacturing plants—be sure to schedule your advertising in the July AERO DIGEST.
ADVERTISING FORMS CLOSE JUNE 17TH

The proposed company, a private corporation, would be given exclusive contracts to carry mail, passengers and express. At first the company will be subsidized for two years, at the end of which time it is expected an efficient service will be operating.

For purposes of organization, a number of officials of the Department of Transport will act as incorporators. They are Col. V. I. Smart, Deputy Minister; R. K. Smith, Director of Marine Branch; Commander C. P. Edwards, Director of Air Service; E. B. Jost, General Superintendent of Canals; and F. M. MacLennan.

Postal rates will be fixed from year to year on the basis that if there is a deficit the first year the rates will be increased the next year to an extent estimated to produce sufficient revenue to meet the deficit. If there is a surplus the rates will be reduced, providing they will not be lower than competitive rates.

Designed to encourage airplane production in Canada, the 1937-38 budget of the Canadian government provides for a 60% drawback allowed on materials, including all parts, imported for use exclusively in the equipment of aircraft. The same drawback is to apply to parts for the assembly in Canada of engines Formerly a drawback was allowed only for parts used in the manufacture of engines. The change allows their assembly in the Dominion, and the duty for the importation of complete airplanes remains.




*Fokker G-1, twin-engined fighter-bomber-reconnaissance powered by 670 hp Hispano-Suiza engines*

In recognition of his contribution to the advancement of aeronautics during 1936, Matt Berry, pilot for Canadian Airways, Ltd., received the McKee Trophy which was presented by Air Vice-Marshall W. A. Bishop, V. C., at the annual convention of the Canadian Institute of Mining & Metallurgy.

A record round-trip flight of 1006 miles—from Rimouskin to Harrington Island on the north shore of the Gulf of St. Lawrence—was made in 8 hrs. and 5 min. by a Canadian Airways plane piloted by V. J. Hatton. More than 800 lbs. of mail and several passengers were flown on the trip. This marked the first time since the inauguration of mail flights along the north shore that the round-trip was made the same day.

United Air Transport, Ltd., of Edmonton has secured a temporary contract to carry ordinary first class mail (up to 600 lbs.) on one round-trip a week basis between Edmonton, Peace River and Grand Prairie, Alberta and Dawson Creek and Ft. St. John, B. C. The round-trip distance is about 1000 miles.

## Denmark

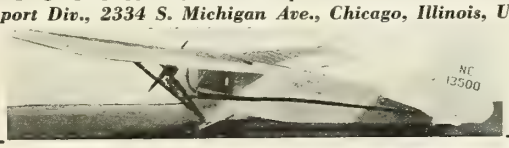
East Asiatic Co. plans to expand its Nakskov Shipyard to provide for the manufacture of airplanes. At present the only planes produced in Denmark are made at the two plants controlled by the army and navy; both of these factories operate on a license basis.

Danish Ministry of Public Works has requested $220,000

(*Continued on following page*)

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(*Continued from preceding page*) for the construction of a new administration building and minor road work for the state airport at Kastrup near Copenhagen. The proposed building should be completed some time before March 31, 1938 if plans materialize.

## France

The Postes Telegraphes-Telephones budget for 1937 is balanced at approximately $250,727,400, of which $467,000 will be used to make a trail of transporting mail by air without additional charge during 1937. As the $467,000 will not subsidize the entire national mail by plane, it is contemplated to utilize train service within the radius of 300 miles of Paris. To insure service over greater distances night flights may be instituted after the installation of beacons and emergency landing fields. It is hoped that night flights can be made to Marseille, Nice and Toulouse before the end of the year.

Individual agreements are sought with certain foreign countries that have instituted air mail destined for France without surcharge, to permit the French to send mail to these countries without additional postage. If the experiment proves successful this year it is felt that it may be possible to eliminate additional postage on air mail between France and its various colonial possessions.

## Germany

The Aero Club of Germany is sponsoring, from July 4 to July 18, an international glider competition on the Wasserkuppe in the Rhön. Each nation will be permitted to enter up to 5 sailplanes, and two pilots may be engaged for each sailplane. In conjunction with the competition, the club will organize an aviation meeting to be held in Frankfurt probably on July 11.

Plans for two large airports are now complete. One will include the present Tempelhof Field at Berlin, which probably will be the world's largest, being three times as large as at present. The other will be built at Munich.

At Templehof additional hangars will be built and a new five-story terminal constructed to house all offices connected with air transportation. Two freight yards, automobile garages and other buildings will be provided.

A railroad tunnel will run under the grounds with a depot directly under the terminal building, providing quick rail connections. The new terminal building will be similar to the present one in design and will have a roof garden which will accommodate 2000 persons.

## Great Britain

Jersey Airways, Ltd., will inaugurate on May 31, a new service between Brighton, Hove and Worthing Airport (Shoreham) and the New Jersey Airport, the flight to take about 80 min., in multi-engined transports.

Shoreham Airport is served by the Southern Electric's own railway station and convenient rail connections will be afforded for air departures and arrivals. Jersey Airways, Ltd., is associated with the Southern Railway and Great Western Railway.

Mail traffic showed a substantial increase in 1936, as compared with that of 1935. Empire services alone carried 33% more mail due partly to rate reductions. Mail from the United Kingdom to Europe increased 179%, when 402,000 lbs. were carried in 1936, compared with 143,000 lbs. in 1935. Part of this increase was ascribed to the carriage of mail to Scandinavian countries without surcharge.

Exports of British aeronautical products—aircraft, engines and parts—achieved a new record figure in 1936 amounting in value to about $15,000,000, or more than $1,000,000 above the previous highest figure recorded in 1935. The first month of 1937 maintained a similar level—$1,253,765, which is more than $250,000 better than the corresponding month of last year.

Successful first flights have been completed by a two-place light bomber, second in this category of warplane announced since the RAF expansion programme was launched. The plane is a monoplane with retractable gear designed by Hawker. Power is derived from the Rolls-Royce *Merlin* liquid-cooled 12-cylinder engine, which delivers a maximum of more than 1000 hp driving a three-bladed controllable-pitch propeller. The bomber has fabric-covered wings supported on a braced girder framework, and fabric-covered fuselage, stabilizer, elevators, fin and rudder.





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## PERSONAIRLITIES

(*Continued from page 74*)

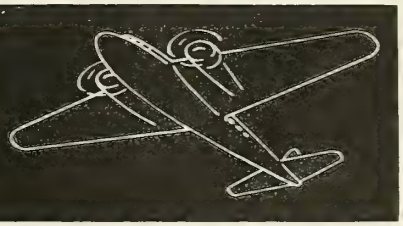
nefarious activities is the writing of pulp fiction, which he enjoys immensely, and acting as press agent for air shows, airlines, and others—this is still in the fiction field, of course.

His aviation work since the war has been largely confined to balloons. He gets into national balloon races and just goes up and is gone with the wind. In 1930 he entered the balloon AERO DIGEST in the race out of Houston, Texas, landing in Daisey, Arkansas, after he and his co-pilot had gone to sleep at 14,000 feet, being slapped in the face by a wet convection cloud. They came to on the way down, with the balloon hurtling to earth with more speed than the Landon presidential boom, another large gas bag that collapsed last year. (All right, I'm resigned by now. Perhaps I wouldn't have liked him, either. Anyhow, no matter who's president, the status of a taxpayer never varies.)

Back in 1924 someone told the old balloonatic about airplanes—which, as a balloonist, he naturally regarded askance. He made a transcontinental hop over the then new air mail route, which for knee-knocking and teeth-chattering was a record in its way. One Jasper Kemper MacDuffie, U.S.A., leader of the recent bombardment round trip flight to Panama, was the pilot, and the plane was an Army Liberty DH. Between dawn and dusk the first day they negotiated the perilous stretch between New York and the old Glenn L. Martin field at Cleveland, on which I was then test pilot, gas pump attendant, ash runway builder, and wiper-offer of visiting ships—I still consider that the best job I ever had. It was certainly the happiest. Next day the pioneers, MacDuffie and Moore, staggered into the air, and by night, after forced landings here and there, whether to repair the Liberty or to ask the way, they hit Iowa City, and bounced three times. It started to rain, and the air mail service stopped for the time being. MacDuffie and Moore were stopped anyhow, with a leaky water jacket. Next morning the pair made Fort Crook, but in taking off their engine conked in the first two miles, which turned out also to be the last two miles, for MacDuffie hit a haystack on landing, and DH No. 1 was a washout. The pioneers walked away from it, trudged back to Fort Crook, and got another DH—an old one that the Commanding Officer had been wishing for some time that some passing pedestrian would remove. MacDuffie and Moore removed it, and in the course of the next week or so, after several forced landings due to engine trouble, weather trouble, and overshooting emergency fields and knocking bits off the wings, and so forth, they sort of sogged down to a landing at Crissey Field. The officers there refused to believe that they had flown such a crock all the way from Omaha. They didn't even salvage the instruments—just wheeled her out near the bay and touched a match to it. That ended DH No. 2. The two survivors pulled wires and got another travel-worn Army DH in which to return to Mitchel. Having flown the mail route out, the intrepid birdmen struck East by uncharted paths, wandering around Chanute, Indianapolis, Dayton, and Washington. They would take off at dawn, fly until something gave way, land and repair it—usually a water leak—take the air again, and come to some place or other, and land and find out what town it was. They were really flying by compass in a generally easterly direction, with the prevailing trade winds. Days went by in this manner, with the MacDuffie-Moore Expedition unreported. But nobody was really worried. It was felt that the pair would finally turn up at Mitchell, with or without the DH. Sure enough, one foggy night the disgruntled roar of a hungry Liberty was heard, and before a landing crew could place lights on the field, the familiar wire-encrusted form of an old DH was seen dimly gliding down to a landing. To the surprise and disappointment of everyone it didn't crash, but landed gently and taxied in. Out stepped the survivors of the famous MacDuffie-Moore Expedition across a continent. Bearded, travel-stained, but triumphant, they saluted the Commanding Officer, who took one look at the DH and then ordered the mechanics to wheel it to the far side of the field, accompanied by a match.


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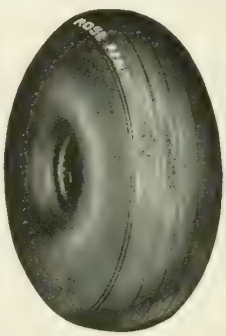
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## FIRE OVER LONDON

(*Continued from page 21*)

preceded by its hail of machine gun bullets, may come in from a different angle and drop small demolition bombs. The third wave will use machine guns, gas, and small fragmentation bombs. All three waves will pass over a battery only once; if they have not expended all of their ammunition and bombs they will use them on a second objective in the general line of flight, after which the survivors of all three waves will high-tail it for home.

This procedure will go on all around and above London, taking no more time than it takes 3-mile-a-minute airplanes to pass. The attack plane of today is a destructive force to be reckoned with, a powerful and elusive opponent.

The departure of the Attacks leaves the defense disorganized, in part destroyed, and as a whole extremely nervous. The defenders are only men, and their nervous reactions to this destructive fire and bombardment may be expected to decrease the efficiency of the survivors. It is conservative to estimate that the ground defensive forces of London may lose half of their effectiveness in guns and searchlights.

Now the main bombardment attack starts. 500 bombers come over at various heights, from various directions, each with its objective one of the squares into which London has been divided. Despite the preceding attack, they encounter barrages of shells and of course the fast English interceptors. Just how effective these interceptors are has never been demonstrated by actual war practice. The last war gives us little on which to base any estimates; the war scouts were comparatively slow and maneuverable; the modern interceptors are fast and not nearly so maneuverable. Furthermore, modern bombers are three times as fast as the bombers of 1918. In the year following May 1917, there were 28 German airplane raids on London with an aggregate of 369 machines, of which they lost 13 by gunfire and 8 by air combat—a loss of only 6% of their effectives. As the increases in bombing height and airplane speeds have at least kept pace with the increase in efficiency of guns and range-finders, this figure may still remain around 6% for losses. If it jumped to 20%—and I guess 10% as a more reasonable estimate—100 bombers would be a small price to pay for the destruction of London. At only 50 bombers lost, it would be a gift—as gifts go in war!

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(*Continued on following page*)


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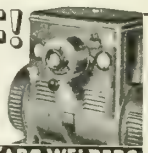
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*(Continued from preceding page)*

and allowing for losses and bombs that land in open areas, 50,000 fires should result. Junkers bombers are now reported to carry 2000 baby incendiary bombs, each weighing only a few ounces. In placing the number per machine at 300 and the weight at 6 pounds I probably have erred—on the conservative side.

Joseph Driscoll, London correspondent of the New York *Herald-Tribune*, quotes from an article by Air Commodore L. E. O. Charlton, Royal Air Force, in which he invites his readers to imagine a "prolonged attack by, say, 300 bombers, acting in relays throughout the hours of darkness during a single night. Allow 20% of the attackers being destroyed by anti-aircraft fire and combat in the air. Thus 240 bombers would get through, and each would carry 300 sizable thermite bombs. They could drop in all 72,000 bombs."

What would the General Staff and the Army do to repel such an attack on New York or Philadelphia or Boston? The Army Air Corps reply may be "counter-bombardment"—but that will not save our cities from destruction, any more than it will save London.

## HUMAN ELEMENT

*(Continued from page* 58)

and an appreciable degree of self-control, this feeling may become a habit of recklessness or carelessness.

Some close calls with no particularly bad consequences make bad matters worse, and soon these pilots harbor an obsession that "all accidents are accidental," and they become fatalists.

Under Point 3, disobedience of orders is treated. We shall define this as disobedience to (or violations of) regulations or operations orders. B. A. C. statistics (1932-1934) show that one of every four violations resulted in accident, and that one of every three of these accidents was fatal to one or more persons. These ratios demonstrate the gravity of violations. Self-discipline on the pilot's part is the only practical manner by which such accidents may be decreased. By comparison the number of accidents due to pilot error in miscellaneous and in scheduled airline operations, we find that pilot error ranks first by a large margin in the former division, but fourth in scheduled operations. This fact doubtless is due to the superior training and discipline exercised upon airline pilots, compared to the freedom possessed by pilots in miscellaneous operations.

A condition known as the "superiority cycle" may so influence the pilot that he unintentionally becomes an accident risk. These cycles, understood by most instructors, are periods in a pilot's career during which an extreme over-confidence is developed, varying according to temperament and intelligence.

Another condition known as "substitute

satisfaction" treats the surrender to impulses. It is always pleasant to do what we want to do—and usually unpleasant to do what we do not want to do. When we please ourselves by surrender to desires, also knowing that the action is wrong, and offer some excuse for the action, the condition of "substitute satisfaction" results. For example: "A man goes to the circus 'to take the kids.'" This habit of offering excuses (to ourselves and others) for mandatory behavior is widely practiced by pilots.

When we set down the term "carelessness" under Point 4 as the cause of accident, we assume that the pilot *knew* better, but actually went wrong. However, this conclusion does not reach the underlying causations. Carelessness (or what appears to be carelessness) may be brought about by conditions not immediately obvious.

Inattention is associated with carelessness. However, this state is not a principal cause, although nearly always expressed in that light. We say an accident was caused by "careless inattention." We associate these conditions wrongly. The state of inattention is not a principal cause and may not be closely associated with the mode of refractoriness. It is the result of one or the other of two conditions known to psychologists as "preoccupation and depression."

Preoccupation is the surrender of the mind to feelings or habits stronger than anything in a present situation. Depression is the mental state in which one's functions are inactive and the responses tardy. Either may work toward bringing about the other, and one or both may cause a state of inattention. Thus these departments of mental error indirectly may cause a reaction attributed to some other cause, and it is essential to get the *underlying* cause in accident investigation.

Negligence is usually associated more closely with omission than commission. This act (or absence of action) is a first cousin of preoccupation. We make instant association with forgetfulness or absentmindedness. Recall, or the act of remembering must be preceded by some form of stimulus—thus the custom of tying a string around the finger to remind one of something he might otherwise forget.

Absent-mindedness is not so much the inability to recall but rather a characteristic of thinking behavior. A preoccupied pilot may encounter difficulties and his response may be inappropriate because of his mental "set."

### Delusion

Delusion, or the state of being misled, is a mode caused by faulty information received through the senses. Under this condition of mind accidents of the "mysterious" variety occur. They rarely present the degree of tangibility in their

(*Continued on following page*)


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*(Continued from preceding page)*

evidences as the group of accidents caused by lack of experience and/or carelessness or negligence.

The nervous system, including our senses, is a means by which parts of our body react to physical contacts with each other, and with the outer environment. The five senses—seeing, hearing, feeling, tasting and smelling, and the various subdivisions of each—have been a subject of controversy among physiologists, psychologists, and medical doctors. Some claim we have nine or more senses, but the five commonly known will suffice for this discussion.

The mind cannot operate independently of its environment as we have no means of communication with the outside world other than through our senses. The need of a pilot having a good equipment of senses is obvious. His senses are his safety messengers. If he cannot trust his eyes, believe his ears, and be confident of his movements, he is not sensive, and is therefore misled.

Point 1 under (b), "inherent disease or defect," treats accidents resulting from a disease or defect demonstrable by physical examination, the nervous system being included. These defects either may be inherent, (not susceptible to remedy within a reasonable period of time) or they may be temporary (remediable, and not subject to frequent repetition).

The human body is such a highly-organized and versatile collection that the loss of a single member of the body, or even a single sense does not impair physical efficiency to an appreciable degree. The loss of a hand is to the loss of a portion of the mind as the entire body is to the entire mind. We hear with a part of the mind, we see with a part of the mind, etc. Therefore, if *all* the mind were active at the same time, the result would be a confusion of conflicting emotions and impressions.

The body has reserves of strength, and the various portions of the mind have unused resources which are rarely called into full activity. Corresponding offsets in the development of a sense, or limb, may result from the loss of the other. The compensation, however, is far from being complete. Improved vision would not altogether console for deafness, nor a more sensitive touch compensate the damage of lost eyesight.

Point 2 under (b), "poor reaction," treats accidents from psychological causes, and not from demonstrable disease or defect. Poor reaction may, like disease or defect, be either inherent or temporary. It may also bring about accident attributable to poor judgment.

Reaction should be compared with time. The term "reaction time" is used here to indicate the interval between stimuli and the resulting action. One pilot will have different reactions for different stimuli. There will prove to be a sight

reaction time, (as seeing another plane maneuvering dangerously close) and another hearing reaction time, (as hearing another ship nearby) etc. In any particular individual these reaction times vary according to his capacity for attention as well as according to his physical equipment. Reaction times also vary according to the degree of stimulus. A loud noise or bright light, near at hand, will produce a more rapid reaction than a faint signal at a distance.

The necessity of stopping to recognize and discriminate between signals, or of choosing between types of reaction to them, lengthens reaction time. Emotional associations prolong it further. This accounts for the difference in ability of various pilots to make quick and correct decisions.

Closely associated with reaction is a feeling of muscular movement called "position sense," the two agencies of which, sight and touch, work more or less independently. If sight and touch are inaccurate, position sense is defective.

In the agency of sight it is usually defective steroscopic vision which impairs judgment of distance and speed. In the agency of touch it may be a faulty sense of balance. An example of this is "seat feel," which is judgment of position from point of contact with the cockpit seat. This feel, developed by experience, may also be influenced by the peculiar activities of the automatic nervous system as well as the semi-circular canals and sense organs.

#### Temperament

Somewhat removed from the former discussion of the mental conditions, yet related and timely, comes a discussion of the temperamental extremes—the excitable, and the phlegmatic.

The excitable is the overactive temperament in which we find a bodily condition, an exciting cause, and a mental condition. In excitement (and its usual cause, fear) the element of recognition is the important thing. It is the mental condition of excitement leading to action. No matter how responsive a pilot's nervous organization may be, if he fails to *recognize* a danger, he suffers no excitement. The recognition sets off the mental response. A noticeable characteristic is the constant visualization of more difficulties and dangers than actually exist.

The phlegmatic is exactly the opposite type and is nearly as great an accident risk in that the pilot is so slow to respond that he cannot "step lively" in situations. If habitual, it is chronic mal-adjustment. As an engineer, designer, or mechanic, such a man might become outstanding in his particular line of work.

Closely related to the temperament is the degree of emotional stability possessed by the pilot. There are often moods

(*Continued on following page*)


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(*Continued from preceding page*)

one experiences which are due to mental strain. The most effective manner in which to escape such moods is to have a certain amount of relaxation, such as hobbies, or pastimes. Pilots are accident risks when affected by these moods and the condition is lack of emotional balance, which is essential to keep in the best physical condition.

Skill is built up by a process of subordinating the conscious mind. A pilot may fly his ship perfectly while his attention is elsewhere, just as a pianist strikes a handful of keys while reading music or looking elsewhere. The hands are forgotten, yet they carry out the intended action with automatic precision.

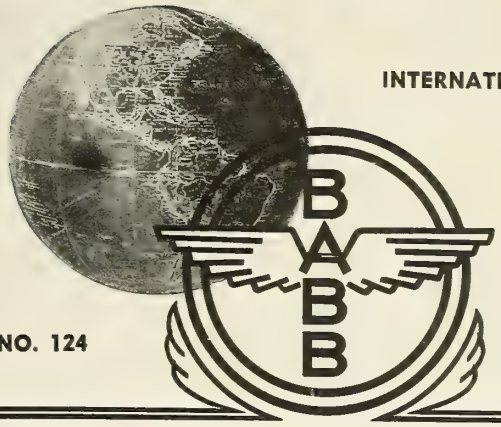
This action is an arbitrary built-up association and is successfully established in correct proportion as the movements become unconscious or reflex. Our bodily offices are most efficiently performed when the will is *least engaged in directing them.* The unconscious centers do the real work, illustrating the importance of the development of good habits, and the elimination of bad. If not corrected promptly, automatic performance will build up bad habits cultivated early in training to a degree of skill or ease. If such habits as flying wing-low, sitting crooked or slouched in the cockpit, flying with jerky movements, etc., are allowed to reach the "automatic" stage in the pilot's development, an entirely new learning process in the particular phase is essential for correction.

Habit is so efficient when correctly directed and so easily replaces conscious *thinking,* that good habits if successfully inculcated can eradicate faulty thinking.

There are subconscious errors to which a pilot is subjected in which the mind tricks itself in respect to true facts. This is typical of a case where our senses fail us and we jump at conclusions, associating in our minds unrealities with realities, because previous experience justified the association. In transition from one type of ship to another, or in employing new or different operations and methods, a pilot may fall into difficulties.

Under these conditions, he is predisposed to accident. When retractable landing gears were innovations, many landings were made with the gear up. The action of lowering the gear was so new, even to experienced pilots, that the habit had not yet been established to the point where it became subconscious or automatic. Warning devices (lights, horns, and other fixtures) now provide the recalling stimulus.

In accident analyses, ascertaining the cause where the pilot's error is in evidence, the scope of investigation will be greatly broadened along psychological lines, and by so doing the number of accident reports bearing such conclusions as "undetermined and doubtful," and "miscellaneous," will be decreased.




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1934 BEECHCRAFT B-17-L: NC14409. 225 hp Jacobs. Light red with black striping; 70-gallon gas capacity. Gray suede upholstery with leather seats. Hand crank landing gear; electric starter, landing lights, flares, bank and turn, rate of climb, Avigo clock, Sperry directional gyro, Pioneer compass, RCA radio, Moonglow and dash instrument lights. Total time 483 hours; 51 hours since major overhauled, including all new cylinders and new bearings throughout. Plane and motor completely majored December 1936. Excellent. $4,750. AERO DIGEST, Box 2616.

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BUHL SEDAN: 6-place, with J-6, modernized. Motor factory reconditioned. Plane completely recovered. Special finish; landing lights. Will sell cheap, take trade. See this plane. Pioneer Aviation, Airport, Syracuse, New York.

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CESSNA WARNER: 125. Privately owned, never cracked. Ship in excellent condition. Licensed until August 1937. Price, $800. Plane Owners Service, Inc., Hangar 7, Roosevelt Field, Mineola, New York.

### Cub

'36 TAYLOR CUB: Just majored, winter enclosure manifold heater, new wheels; color, yellow and black; good as new. Just relicensed. $1000 cash, no trades. Moore Flying Service, Dayton, Ohio.

FAMOUS 1000TH Taylor Cub: Same as brand new. Only 30 hours total. Dual ignition, special paint. Bargain at $1,200. Jake Boyd, West Palm Beach, Florida.

TAYLOR CUB J-2: Less than 100 hours. Privately owned. Exhaust heater, cabin heater, compass. $950, cash. L. R. Furlong, Clarion, Pennsylvania.

TAYLOR CUB A-40-3: 20 months old. Enclosure and compass. Just relicensed; never cracked. $775; $450 down. Can finance. Alex Janaulis, 903 Blaine, Detroit, Michigan.

1935 TAYLOR CUB: Silver trimmed in maroon. Winter enclosure. 675 hours total, 40 since major on ship and engine. Clean as a whistle. $850. $425 down. Will take trade. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

1936 CUB J-2: Winter enclosure, heater; yellow and black stripe. Total time 232 hours; majored at 200. Perfect condition; licensed; never cracked. $850. P. R. Witcher, Farmville, Virginia.

CUB J-2: Yellow and black; no time since major on motor; ship ten months old, never cracked, wonderful shape. $950. Terrell Flying Service, Lenoir, North Carolina.

TWO J-2 '36 CUBS: Less than 150 hours each. Exhaust collector heaters. $950 and $1,050. Akron Airways, Airport, Akron, Ohio.

CUB: New October 1935. Special paint job; beautiful condition. Engine just majored. Never cracked. Can finance. Max Rappaport, Roosevelt Field, Mineola, New York.

### Curtiss Robin

CURTISS ROBIN OX5: Licensed; condition good; recently refinished. New motor, wheels, tires and tubes. $395. Bayside Airport, Hingham, (Boston), Massachusetts.

ROBIN: Challenger 185; good condition. New finished, upholstered. Licensed 1938. Blind flying instruments. Weather observation ship. Price, $1,095. Ted Mount, Skyways Hangar, Cleveland Airport, Cleveland, Ohio.

CHALLENGER ROBIN: Special paint job, nickel plated struts and fittings. New air wheels and tires. Privately owned. Licensed until March 1938. A-1 condition. You will have to see this plane to appreciate the value and bargain. Dale Lapham, Kellogg Airport, Battle Creek, Michigan.

$500 BUYS OXX-6 ROBIN: 3-place cabin, new motor. Scintilla magneto, oleo landing gear, duals, fabric perfect. Inspect this unusual buy. Write Pioneer Aviation, Airport, Syracuse, New York.

### Curtiss-Wright

FLEDGLING CHALLENGER: Equipped for banner towing; licensed; finance. $750. Brayton Flying Service, Inc., Robertson, Missouri.

### Davis

DAVIS, LEBLOND 65: 30 hours since overhauled. Airplane completely gone over and recovered July 1936. First $700 takes ship, licensed. Adolph Schuch, Jr., Kewaunee, Wisconsin.

### Doyle

DOYLE: LeBlond 65, two-place tandem monoplane. Duals, licensed until April 1938. Ship and engine overhauled, fabric refinished. Fast, economical, good performer. $700 cash. Harry Troxell, Municipal Airport, Pontiac, Michigan.

### Eaglerock

EAGLEROCK A-3: 180 Hisso, 3POLB; licensed to May 15, 1938. Brakes, Micarta adjustable prop, compass, air speed, etc. Ship and motor completely majored. Real performer; cruises 100 mph at low cost. $295 down. Ray Grenzow, 517 Spicer Street, Akron, Ohio.

MUST SELL AT ONCE: De Luxe J6-5 Eaglerock, like new; total time 100 hours; $1,175. Kinner K-5 Eaglerock, steel prop, large wheels, 171 hours; $725. Alexander Flyabout, 180 hours, $600. OXX-6 and OX-5 Eaglerock, few hours, very cheap. Write or wire Niagara Skyways, Genesee and Union Road, Buffalo, New York. Fillmore 4850.

OX COMBINATION EAGLEROCK: Just relicensed. Motor and ship completely majored. New prop, new magneto, expander rings, etc. Very attractive color combination. $390. T. U. Lowden, Pittsfield, Massachusetts.

$150 DOWN BUYS OX combination Eaglerock, recently recovered. Licensed, not restricted for acrobatics. Excellent condition; will accept car or airplane in trade. Balance financed. Central Air Service, Inc., Grand Rapids, Michigan.

### Fairchild

FAIRCHILD "22": Cirrus Hi-Drive motor. Licensed to January 1938. Various extras, including choice of tail wheel or skid. Excellent condition and appearance. $1,175 cash. Smith Flying Service, Wilkes-Barre Wyoming Valley Airport, Forty-Fort, Pennsylvania.

FAIRCHILD "24's": $3,000 to $4,500, condition certified, many extras, condition of all excellent. Other used ships: Aeroncas, Wacos, Robins, Fleets; $275 to $4,300. Opportunity to save. What do you want? Write for list. Warren Holladay, Rapidan, Virginia.

1936 RANGER-POWERED Fairchild 24: Perfect in every way; 150 hours total time. Bargain for quick sale. L. T. Hansard, Municipal Airport, Houston, Texas.

1935 WARNER-POWERED Fairchild 24: Turn and bank, rate of climb, generator, special paint job. Fifty hours since major; guaranteed perfect. Clyde Foreman, 1603 Pease, Apt. 5, Houston, Texas.

FAIRCHILD: Warner "24", 1935 model. Gray and orange; 240 hours total. Has radio and is in new condition. $3,475; will take trade. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

FAIRCHILD "24": Cirrus; just recovered, refinished, major overhauled, relicensed. Perfect shape. Will sell or trade on cheaper ship. Aviation Supply Corporation, Municipal Airport, Atlanta, Ga.

1936 RANGER FAIRCHILD "24": Never cracked and looks brand new. 124 hours honest time. Standard equipment, including flaps, generator, starter and brakes. Finished ivory with blue striping. With exception of minor changes in styling, this is same ship as 1937 model selling for $5,990. My price, $3,990 cash. No trades. Max Marshall, Xenia, Ohio.

FAIRCHILD KR-31: OX-5. Complete set of instruments. Full airwheels; new mail-type windshield. One of the best OX jobs ever built. $495 or less with standard wheels. Finance 50%. John T. Corrodi, Inc., Box 185 Bexley Station, Columbus, Ohio.

FAIRCHILD 22: Warner 125. Turn and bank, rate of climb; 80 hours on engine since purchased from factory. Manufactured September 1933. Price, $1,700. No trades. Plane Owners Service, Inc., Hangar 7, Roosevelt, Mineola, N. Y.

FAIRCHILD: 3-place cabin Model F2A-C80. NC-14362. 1934 Warner 145 hp; wood prop; light red paint with black striping. Light tan leather upholstery; wheel pants, paint and fabric in A-1 condition. Wind-driven generator, Westport radio, bank and turn, rate of climb, Jaeger clock, 1937 Pioneer compass, 40-gallon gas capacity. Dual controls, float fittings. Plane equipped for aerial photo work with drift and camera floor holes installed; also pilot floor window. Electric starter. Total plane-engine time, 330 hours. $3,300. AERO DIGEST, Box 2616.

1935 WARNER-POWERED Fairchild 24: Early model, without flaps. Radio receiver, turn bank; guaranteed to be in tiptop shape. Bargain for cash. R. E. McKaughan, 3706 Harper Street, Houston, Texas.

WARNER-POWERED Ranger airplane: In best of condition; has air wheels, brakes, steel prop and goes for $750. Air Activities, Inc., Municipal Airport, Houston, Texas.

### Flamingo

FLAMINGO: NC656E. 8-place all metal monoplane; 430 hp B Wasp motor. Full night flying equipment, generator, starter, radio; fully equipped for all aerial photo work. 148 gallons gas capacity. Cruises 135 mph at 8,000 ft. Total time 1200 hours; 200 hours since major on engine. Just relicensed and in perfect condition. $2,100. AERO DIGEST, Box 2616.

### Fleet

FLEET MODEL 2: Newly recovered. Beautiful condition and appearance. Kinner motor. Full air wheels, duals, extra instruments. $1,350 cash. Will deliver free. Radiant Oil Company, Miami, Florida.

LICENSED 3POLB: Fleet, B-5; dual brakes, 39 gallons gas, tail wheel, rate climb, turn bank; good condition. $1,450 cash. Frank Eng, 102 Blanco, San Antonio, Texas.

### Great Lakes

GREAT LAKES 2T1A: Licensed to March 1938. Just spent $700 recovering and majoring ship. Absolutely perfect. 653 hours total, none since major. $975; $487 down. Will take trade. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

GREAT LAKES: Cirrus motor; licensed. Always hangared, never cracked; excellent condition. Air-wheels, special paint. Original log books. Economical and safe. Real bargain at $795. Jerry Church, Sun Prairie, Wisconsin.

GREAT LAKES 2T1A: New engine and special equipment. Landing lights, navigation lights, wheel pants, brakes, bank and turn, front cockpit cover, mail-type windshields; condition excellent throughout. $1,050; finance 50%. John T. Corrodi, Inc., Box 185, Bexley Station, Columbus, Ohio.

### Kellett

KELLETT K2A AUTOGIRO: Continental 210 hp. Less than 150 hours on engine; 450 hours on ship. Side-by-side seating. Completely overhauled. Privately owned. Closed cabin. Licensed. Good for advertising and dusting. Steel propeller. Hangared. $1,800 cash. AERO DIGEST, Box 2607.

### Laird

LAIRD WHIRLWIND: 3-place open cockpit. Excellent condition; $1,750. Write for used plane list. E. M. Laird Airplane Company, 5917 S. Cicero Ave., Chicago, Illinois.

### Lockheed

PARKS AIR COLLEGE offers: 5-place J-5 Lockheed. With or without newly overhauled J-5 engine. Equipment includes Goodrich air wheels, speed ring, rate of climb, electric or hand inertia starter. Licensed to 1938. Red fuselage, fin and rudder; Diana cream wings, stabilizer and elevators. A bargain for quick disposal. Write, wire or phone for further particulars. Parks Air College, Inc., East St. Louis, Illinois.

### Lincoln

FOR SALE OR TRADE: Lincoln 3-place cabin; B-5 125 hp Kinner. Licensed, airwheels, brakes, tailwheel, steel propeller, starter. Price, $1,495. Reply John Ruzicka, Peru, Indiana.

### Monocoupe

WARNER MONOCOUPE. Truly fine condition throughout. Absolutely no reconditioning needed. Privately owned and never scratched. Demonstrate anywhere for expenses. Smith-Central, 18 E. Main, Clinton, Connecticut.

WARNER MONOCOUPE: 125 hp, 1930 model known as Monosport; 375 hours total time; navigation lights, steel propeller, speed ring, brakes, all Pioneer instruments, including rate of climb, Elgin clock, compass, all struts streamlined, duals, leather upholstery, cabin heater. Norvell Deruy, Pittsburg, Kansas.

LAMBERT MONOCOUPE: Factory rebuilt motor installed 100 hours ago. Ship completely refinished high gloss red, black trim. Oleo and racing landing gears; oleo on ship. Pants, ring, battery, navigation lights, standard instruments. Privately owned and guaranteed perfect condition. R. Nickerbocker, 563 South Lake, Aurora, Illinois.

NEW 1937 LAMBERT Monocoupe: Starter, battery, rate of climb, bank and turn, generator. Completely shielded, navigation lights. Bargain for cash. AERO DIGEST, Box 2600.

1936 DE LUXE MONOCOUPE 90-A: Radio, battery, generator. Ship just beautifully refinished and motor overhauled at factory. Never cracked, 150 hours total time. $3,250. Culver-Bates Aircraft Sales Corp., 68 Preston Road, Columbus, Ohio.

LAMBERT MONOCOUPE: $1,100. Excellent condition, steel prop, brakes; 200 hours total time on ship and motor. Licensed to December 1937. No trades. R. J. Morrison, care Poughkeepsie Airport, Poughkeepsie, New York.

MONOCOUPE: 125 B-5 Kinner; licensed until April 1938; 326 hours; motor and ship in excellent condition; black and silver. $1,500. J. W. Barnhill, Owensboro, Kentucky.

MONOCOUPE: Kinner 125. Ready to go and with Performance Plus. Cruises 125 mph. Approximately 40 hours since recover, refinished, and a real major on motor. This particular ship is a rare bargain for $1,475. D. A. Jensen, 2125 Fourteenth St., N. W., Washington, D. C.

MONOCOUPE: Powered with Warner Super Scarab 145 motor. Time less than 200 hours since new. Equipped for night flying. Bonded, shielded for radio. Radio receiver installed. Tunnel cowling. Very clean. Becker-Forner Flying Service, Inc., Jackson, Michigan.

FOR SALE: Late model D-145 Monocoupe; powered with 145 hp Warner motor. Equipped for night flying; also radio equipped. Built to cruise 140 mph: top 160. Well streamlined. Price, $2,850. AERO DIGEST, Box 2613.

LAMBERT MONOCOUPE: 335 hours total time; 73 hours on engine since complete major. Airplane recovered and finished in high lustre throughout. Special equipment: left door, engine cowling, wheel pants, tail wheel, special upholstery, clock. $1,800; finance 50%. John T. Corrodi, Inc., Box 185. Bexley Station, Columbus, Ohio.

LAMBERT MONOCOUPE: Delivered March 1936. Privately owned, never cracked. Color black, orange and red trim. Price, $2,750. Will consider trades. Plane Owners Service, Inc., Hangar 7, Roosevelt Field, Mineola, New York.

### Moth

GIPSY MOTH: Air wheels, instruments front and rear, special British air screw. $575, no trades. E. B. Bergman, 9010-180 Street, Jamaica, L. I., N. Y.

MOTH, GIPSY: Cleanest and best Moth in country. Absolutely perfect condition. 404 hours total time, 100 hours since major. $795; $395 down. Will take trade. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

DH MOTH: Just recovered; motor overhauled; licensed in October; priced to sell. Chicago Aviation Corporation, Glenview, Illinois.

### New Standard

J-5 NEW STANDARD D-25: 5-place; equipped with air wheels, steel propeller, just recovered; motor majored 8 hours since. A-1 shape all round, never cracked up. Price, $2,500. C. Descomb, Crystal Drive, Wethersfield, Connecticut.

### N-B Trainer

FOR SALE OR TRADE on autogiro: Nicholas-Beazley two-place, NC. Genet "80". Want new or used two-place Giro. Dr. J. H. Davis, Belle Fourche, South Dakota.

BARLING NB-3: Licensed, recently recovered, motor overhauled; new prop. Will finish your colors. $750 cash; terms or trade. Art Smith, 508 Lloyd Street, Pittsburgh, Pennsylvania.

### Pitcairn

J-5 PITCAIRN PA-6: Motor just majored, with 6 hours time; full set instruments, landing lights, shielded for radio. Whole ship in perfect condition. Karl F. Pausewang, Sayville, New York.

### Pitcairn Autogiro

AUTOGIRO: Pitcairn PCA-2. Three place; Wright R-975E J6-9 330 hp engine. Licensed October 1st. 1300 hours. Equipped for towing advertising banners. 75 detachable six-foot letters. Everything, $1,500. Consider separate sale engine, ship, parts, or trade. Hermitage Airport, Richmond, Virginia.

### Porterfield

'35 PORTERFIELD: 70 LeBland, 125 hours total time. Appearance and condition like new; always hangared; $1100. J. C. Tankersley, Municipal Airport, Little Rock, Arkansas.

PORTERFIELD: LeBlond 70, special finish, speed ring, brakes, tailwheel. Like new. 47 hours total time. Sacrifice. Answer all inquiries. Cecil Davis, 3511 Hart, Detroit, Michigan.

SACRIFICE SALE: New LeBlond de luxe Porterfield. Special finish and loaded with extras. Real buy. Michigan Aeronautical Corporation, Waco and Rearwin Distributors, Ypsilanti Airport, Ypsilanti, Michigan.

### Rearwin

REARWIN SPORTSTER 70: Brakes, bank indicator, pitch indicator, speed ring, carburetor heater, Kollsman compass, air speed. Total time less than 75 hours. Excellent condition. No trades. Price, $1,850, flyaway Clarksburg, W. Va. I. D. Jackson, Clarksburg, West Virginia.

REARWIN: LeBlond 85. 1936 model, red trimmed in blue. 332 hours since new. Just topped. Many extras, including brakes. For quick sale, $1,895. $950 down. Will take trade. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

LE BLOND 70 REARWIN Demonstrator; New condition; brakes, speed ring, compass, carburetor and cabin heaters. Bargain. Michigan Aeronautical Corporation, Waco and Rearwin Distributors, Ypsilanti Airport, Ypsilanti, Michigan.

DE LUXE WARNER Rearwin Sportster: New February 1937. 60 hours total time. Ship like new. Equipped with ball-bearing controls, extra large baggage compartment, air wheels and brakes, speed ring, carburetor air heater, steerable tail wheel, battery and navigation lights, thermocouple, Kollsman compass, ball bank indicator, etc. This ship can be financed. Price reasonable. Huchendorf Flying Service, Inc., Clover Field, Santa Monica, California.

REARWIN SPORTSTER: 70 hp LeBlond; 1935 model. Never cracked, perfect condition. 320 hours total. Recently topped. $1,395. $695 down. Will take trade. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

### Ryan

RYAN B-1: Licensed to March 1938; $1,150. J-6 ex. valves, new, $6. J-5 ex. valves, used, $2. Many other J-5 and J-6 used parts. Write for price list. Ralph Pretty, 3928 Folsom Avenue, St. Louis, Mo.

FOR SALE: Ryan ST-A: Beautiful ship; excellent condition. For quick sale, $3,750. AERO DIGEST, Box 2595.

RYAN B-1: Best in the United States; plane completely rebuilt; hand-rubbed finish; Stearman vermilion; landing lights, flares; trade or finance. Large tail group. $1,750. Brayton Flying Service, Inc., Robertson, Missouri.

RYAN B-1: Wright J-5. $900. Ship recovered last year. New upholstery and seats, new tires. No time on motor since overhaul; very little total time. Finished vermilion and black. Would consider late model car as part. Send for photo. Earl L. Smith, Rt. 2, Alexandria, Virginia.

RYAN B-1, J-5: Five-place. Silver with red trimmings. Very good condition. $975. $487 down. Will take trade. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

RYAN B-5: J6-9; 120 hours since major of engine. Completely equipped for aerial mapping. Would also be efficient for dusting. Located Omaha, Nebraska. Price, $1,500. Ryan B-3: J6-9. 100 hours since major of engine. Can be licensed for six-place with J-5. Completely equipped for aerial mapping. Ideal for barnstorming small fields. Price, $1,400. Located Teterboro Airport. Both planes owned by Standard Aerial Surveys, Inc., Hackensack, N. J.

B-1 RYAN J-5: Cabin monoplane, 5-place, excellent condition; full of extras. Licensed to September 1937. $975. May consider trade or finance. Fred Rigler, 1049 Lincoln Place, Brooklyn, N. Y.

ST-A RYAN: 1937, NC17300. 125 hp Menasco motor. All standard factory instruments, including compass. Electric starter, booster, battery; wired for lights. $4,500. AERO DIGEST, Box 2616.

### Savoia-Marchetti

SAVOIA MARCHETTI: 5 hours since major; new bottom, new tires, new covering; blind flying instruments, Heywood air starter, new pontoons. Relicensed this spring. Ship in first class condition; ready for delivery after May 1st. Will take 85 hp or 90 hp low-wing Aeronca in trade. Raymond Green, Fulton, New York.

### Sikorsky

SIKORSKY S-39 AMPHIBION: NC 809-W; Pratt & Whitney 400 hp motor. Gray hull, silver wings. RCA radio, turn and bank, rate of climb, long distance gas tanks, special streamline. Beautifully finished. Total time since complete overhaul, 290 hours. $13,000. AERO DIGEST, Box 2616.

### Star

STAR CAVALIER: Licensed; Velie with 25 hours since majored. Duals, white and red paint job, instruments. Ship in excellent condition. $750 flyaway. R. W. Merrifield, Box 525, Aberdeen, S. D.

GENET CAVALIER: Wings and empennage recovered. Brakes, air speed, compass, speed ring. Licensed until April 1938. 460 hours. $700. Rex Rowland, Municipal Airport, Oklahoma City, Oklahoma.

### Stearman

STEARMAN 4-D: Wasp Jr. Completely recovered, beautifully finished in red, trimmed in white. Blind flying instruments, radio, transmitter, lights, speed ring and many other extras. Cruises 128 mph. Will trade for Stinson or Fairchild 24. Aero-Ways, Inc., Cleveland Airport, Cleveland, Ohio.

### Stinson

STINSON SM8A: Licensed July. Engine just topped; new rings, valve springs, clean throughout. $1,250. Almost complete DH Gipsy engine, with Gardner propeller; 80 hours total time, $100. Gas tank, $18. Russell seat pack chute, 24-foot, excellent, $50. Neujahr Flying Service, Bagley, Minn.

1933 STINSON: Blue and yellow color; turn and bank; large gas tanks; rate of climb; electric landing lights; flares; trade or finance. Brayton Flying Service, Inc., Robertson, Missouri.

FOR SALE OR TRADE: Two Stinson U Trimotors. Standard instruments, landing lights and flares. Will take small ship in trade. Blue Bird Air Service, Municipal Airport, Chicago, Illinois.

1936 GULL WING STINSON: With 245 hp Lycoming. Smith adjustable propeller, 70-gallon gas tank, RCA radio receiver, beacon and broadcast, landing lights, flares, rate of climb, bank and turn, thermocouple, leather upholstering. Beautiful black and silver finish with red pin stripe. Engine and plane in perfect condition. Privately flown since new. Never damaged in the least way. Waxed and polished every two weeks. 170 hours on engine and plane. No plane could have had better care. Bargain at $6,500. No trades accepted. H. F. Wood, 228 South 19th Street, Birmingham, Alabama.

STINSON 'S': Licensed to February 1938; 60 hours since major; lights, flares, bank and turn, extra battery. $1,775. L. A. Shell, La Junta, Colorado.

STINSON: 1933 model, four-place; Lycoming. 100 hours since majored. Never cracked; perfect condition. Extra equipment includes turn and bank, pitch indicator, landing lights, flares and radio. Price, $2,975; $1,475 down. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

THREE STINSON trimotored Airliners. All licensed and flying. One model "U", built 1933, $2 875. One model "T", excellent condition, $2,650. One model "T", fair condition, $1,975. Can finance or take trade. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

1937 STINSON SR9B: Practically new, perfect condition. Total time approximately 50 hours. Attractive price. Stinson SR5A: 4-place 245 Lycoming. Total time, 1,000 hours. Exceptional buy. Price, $3,500. Aircraft Industries, Inc., Grand Central Air Terminal, Glendale, California.

STINSON TRIMOTOR: Motor time since major, 170 hours, 55 minutes. Average oil consumption per motor, ½ pint per hour. Wing covers 1 year old. All covers in A-1 shape. New wheels, outside brakes. Modernized pilot's compartment. Night and blind flying instruments. $2,475. Part can be financed. Ken Oliver, Laredo, Texas.

STINSON SEAPLANE: Model S, Lycoming; wheel gear, skis. Also sell separately 3300 floats, engine, Lycoming oil pump, compass, sensitive altimeter. Leithold, Airport, St. Paul, Minnesota.

STINSON SR-6: Smith controllable; special high-gloss finish on fuselage and wings, genuine leather upholstery, bonded and shielded for radio; landing lights, generator, Kollsman altimeter and compass, turn and bank, rate of climb, thermocouple. Low total time. This ship looks like new. A real buy. $4,995. AERO DIGEST, Box 2608.

STINSON 1934: Perfect condition; Lycoming factory majored, extra and night equipment, large tanks, 350 total hours. $3,600. George R. Farmer, 149 Elm Road, S. E., Warren, Ohio.

WE HAVE STINSONS of all models from 1930 to 1936. Will trade or finance. 1934 Stinson, needs rebuilding; fuselage and landing gear and tail okay; will sell with or without engine; total time 140 hours. Chicago Aviation Corporation, Glenview, Illinois.

LYCOMING STINSON S: Complete in every respect. Late type engine with heavy crankshaft. Fabric, finish perfect. Will sell cheap. Inspect this Stinson. Pioneer Aviation, Airport, Syracuse, New York.

$750 DOWN BUYS 330 hp 6-place cabin Stinson; starter, new air wheels and brakes. Small amount of time since major overhaul. Excellent condition. Accept light car or airplane part of down payment. Balance financed. Central Air Service, Inc., Grand Rapids, Michigan.

STINSON SM8A: Late type landing gear, factory modernized motor. Excellent finish. Priced to sell. Write for photo and information. A. G. Becker, Pittsburgh-Bettis Airport, Dravosburg, Penna.

1936 GULLWING STINSON: Radio compass, gyro instruments, 35-watt transmitter, generator, controllable pitch propeller, lights and flares. Less than 100 hours total time; never damaged. Will sell with or without special equipment. Chicago Aviation Corporation, Glenview, Illinois.

STINSON SM8A: Manufactured in May 1930. Never cracked, excellent condition. Total time since new, 550 hours. Leather upholstery. Very clean. Price for quick sale, $1,250. $625 down. Will take trade. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

MODEL R STINSON: Engine recently overhauled. New glass, rugs and battery. Landing lights, flares. Appearance and condition guaranteed. $2,300. Chicago Aviation Corporation, Glenview, Illinois.

## *Travel Air*

J6-9 WRIGHT, modernized to 'E'. Travel Air 6-7 place; recovered. Licensed to February 1938. Late 1935 Continental Cub, reasonable. Wanted Warner speed ring. Ellis Eno, Airport, Fort Dodge, Iowa.

OX TRAVEL AIR: Scintilla mag, newly recovered, motor majored, air wheels, beautiful rubbed finish, just relicensed. Bargain. Also Lycoming hub. M. L. Powell, 1049 So. 29th St., Omaha, Nebraska.

OX TRAVEL AIR with steel prop. Fabric almost new; motor in good shape; make offer. Air Activities, Inc., Municipal Airport, Houston, Texas.

TRAVEL AIR 2000: Just recovered. Twelve coats dope, rubbed finish; Stearman vermilion with silver wings. Never cracked. Excellent condition. Licensed. OX-5, hours 85 since major. Price, $600. See ship at Arrow Airport. M. E. Radford, Box 1310, Lincoln, Nebraska.

FOR SALE: Speed Wing Travel Air; 300 Wright. Equipped for skywriting. $1,500. Art Goebel, Bartlesville, Oklahoma.

TRAVEL AIR B-4000: J-5 motor. 680 hours total time. Ship being completely rebuilt, major overhauled and recovered at present time. Price, $1,295, licensed and ready to go, in perfect condition. $650 down. Will take trade. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

OX TRAVEL AIR: Uncovered. Has Bendix wheels and brakes. Excellent for parts. Prefer to sell all. Cheap. Letters answered. Charles Henry, R. 5, Box 53, Morgantown, West Virginia.

CURTISS-WRIGHT Travel Air sport trainer: Warner engine, 125 hp. $1,250 cash. Will trade. Hal Knoche, 710 Richards Road, Kansas City, Missouri.

TRAVEL AIR Model 2000: With detachable motor mount for conversion to J-5; new license, covering; entire plane refinished. We solicit your inspection. Pioneer Aviation, Airport, Syracuse, New York.

TRAVEL AIR SPORT: 125 Kinner, steel prop, brakes, semi-tires, tail wheel, navigation lights. Licensed to October 1937. $1,385. Fred Slinkard, 6822 Corbitt Avenue, St. Louis, Missouri.

TRAVEL AIR: NC9917. Open cockpit. B9-4000. Black with red striping; motor cowl. 330 hp Wright; very fast and in A-1 condition. $1,800. AERO DIGEST, Box 2616.

J-5 TRAVEL AIR: Speed wing; engine majored; fabric new; special streamlining; motor ring, brakes; snappy airplane, a real pleasure to fly. Will trade; terms. Pioneer Aviation, Airport, Syracuse, New York.

## *Viking*

KITTY HAWK SEAPLANE: Kinner 125. Especially prepared for salt water. Turn and bank, rate of climb, thermocouple. Just relicensed. Motor and ship in fine shape. Bargain, $1,295. AERO DIGEST, Box 2609.

KITTY HAWK: Kinner K-5; bank and turn, Heywood starter, reinforced heads, booster. 25 hours since major. Silver and red. Price $1,095. Rock's Flying Service, Bristol, Vermont.

## *Waco*

WACO CABIN: Continental; late 1933. Full blind and night flying equipment, Heywood starter, 5 hours since majored; A-1 shape all round. Price $2,500. C. Descomb, Crystal Drive, Wethersfield, Connecticut.

FOR SALE: Waco F, Warner; steel prop, starter, in good condition; licensed to April 1, 1938. Reason for selling, owner buying cabin ship. AERO DIGEST, Box 2591.

WACO CABIN: 32 hours since engine majored and completely modernized at factory; bank and turn, rate of climb, landing lights, flares, steel-propeller, wheel pants, Cadillac blue hand rubbed finish, licensed to December 1937. Excellent condition throughout. $2950. Can use smaller ship in trade. H. H. Emrick, Central Airport, Camden, N. J.

WACO 90. Licensed; condition fine; special paint job. Motor just majored. New balloon wheels, tires, tubes. Spare motor. $395. Bayside Airport, Hingham, (Boston), Massachusetts.

WACO DSO: 180 Hisso. Late model, NC629N. Excellent ship for banner towing or crop dusting; J-5 performance. Brakes, tail wheel, booster. 30 hours since motor completely rebuilt. Spare motor. For sale or trade on Waco F, Monocoupe, Cessna or Bird, serviceable or needing repairs. Murray C. Taylor, 112 Sunset Place, Latonia, Kentucky.

1933 DE LUXE WACO Cabin: 210 Continental; full set of instruments; landing lights, radio, starter. 109 hours since major; licensed to April 1938. Excellent condition. $2,500. J. C. H. Groomes, P. O. Box 133, Springdale, Pennsylvania.

WACO CABIN: De Luxe 1934; Jacobs 225, majored and modernized at Jacobs factory less than 300 hours. Looks like new; complete in every respect. Radio, lights, flares, bank and turn, Kollsman sensitive altimeter, eight-day clock, 70 gallons gas capacity, wheel pants; entire ship finished Waco vermilion, hand rubbed high gloss; extra steel propeller; two parachutes. Harold C. Westfahl, 925 East Keefe Avenue, Milwaukee, Wisconsin.

WRIGHT-POWERED 1934 Waco de luxe Cabin: Turn and bank, rate of climb, radio receiver, air brakes, generator, Heywood air starter, flares, landing lights; 15 hours since complete recover, refinished and major. Priced to sell. J. D. Reed, 1565 Telephone Road, Houston, Texas.

WACO CABIN: Continental 210 hp engine; excellent condition, licensed until July 15th. Will sell very reasonably. See or write Allen Bowsher, Clinton, Missouri.

WACO F: Kinner 125. Ship just recovered and motor overhauled. No time since. Bargain, $1,500. Waco C: Continental 165. Priced right. Bob Curry, Seymour, Indiana.

WACO 9: A-1 condition. Always hangared; licensed till November 1937. Newly covered. Travel Air blue fuselage, yellow wings. 300 hours total time. $295. Andrew Stough, 222 South Francis, Lansing, Michigan.

WACO GXE: Motorless; whole or parts; priced for quick sale. Wings, tail surfaces perfect. Write or wire: Charles J. Coyle, 2532 South 15th Street, Philadelphia, Pennsylvania.

WACO J6-5: 3-place open BSO; motor modernized. Airwheels, brakes, ship recently recovered. Bargain. Color, black and gold. Or will trade for late Taylor Cub. Ringel Flying Service, 917 Bigelow, Peoria, Illinois.

WACO CABIN: 1933. 210 Continental, excellent condition; gray and silver, blue trim. Full set instruments, landing lights, flares, radio. Airplane 540 hours. Relicensed April 1938; engine 260 hours since new. No time since major. Price, $2,875. United Aero Corporation, P. O. Box 222, San Antonio, Texas.

1933 WACO CABIN: Manufactured 8-33. Continental R-670, modernized; salt-cooled valves. 70 hours since major at factory. Steel prop, starter, radio, 70-gallon tanks, air brakes, landing lights, flares, turn bank, special clock and blue leather upholstering. Ship finished in aluminum and gray. A-1 shape. Price, $2,750. State College Air Depot, Inc., State College, Pennsylvania.

1935 WACO: Standard cabin. 225 Jacobs. Privately owned; condition excellent; looks like new. Equipment in addition to standard instruments includes: radio, bank and turn, rate of climb, generator and heater. Time less than 200 hours. Reason for selling: to settle estate. Price, $3,800. Harold D. Swank, Scranton Airport, Scranton, Pennsylvania.

WACO GXE: OX-5. Exceptional condition. Positively no repairs needed. New prop. Turns 1425. 30 x 5 wheels. Air speed, duals. NC9568. $500. Also good OX-5 Challenger, $475. S. Cavalier, Airport, Atlantic City, New Jersey.

WACO 1936 Custom cabin: Lights, flares, bank and turn, climb, clock, radio, pants, steel prop, large tanks; 5-place; Insignia blue with cream trim. 225 Jacobs; 8 months old. Less than 150 hours. Never scratched; priced to sell, cannot be told from new ship. Dixie Airways, Inc., Shushan Airport, New Orleans, Louisiana.

WACO A: 170 hp Jacobs; adjustable metal propeller; Heywood starter. Large luggage capacity. Excellent small field ship. Price, $1 090. Gillies Aviation Corporation, Hicksville, L. I. Telephone: Hicksville 1070.

WACO 10: OX-5 motor. Licensed until September 1937. Fuselage and tail surfaces recovered. Fine shape. $380 cash, or terms. L. E. Pickard, Dansville, New York.

1934 CABIN WACO: 210 hp Continental motor; lights, flares, radio. Priced below the market. Chicago Aviation Corporation, Glenview, Illinois.

WACO: 150 hp Hisso; 5 hours since top overhauled. Plane in good condition, with new prop. Stressed up to J-5. Excellent performance. Price, $650. Cleveland Air Service, Berea, Ohio.

WACO A: Late 1933 Jacobs; 20 since major. Radio, bank and turn, Heywood starter, wheel pants, speed ring; yellow fuselage, green wings; excellent condition. $1,750; finance 50%. John T. Corrodi, Inc., Box 185, Bexley Station, Columbus, Ohio.

1934 WACO CABIN: Jacobs. Modernized. Instruments include Sperry group. Radio, night equipped; extra tanks. Morocco leather interior. Excellent finish. $3,650. Inter City Airlines, Inc., Boston Airport, East Boston, Massachusetts.

WACO 1934 de luxe cabin: 335 hours; many extras; splendid condition. Used as demonstrator only. Michigan Aeronautical Corporation, Waco and Rearwin Distributors, Ypsilanti Airport, Ypsilanti, Michigan.

WACO F-2: 170 Jacobs; good condition; flares, landing lights, starter; $1,750. Trades considered with cash difference. Lytle, 2333 Vodeli Street, Pittsburgh, Pennsylvania.

FOR SALE OR TRADE: 2 Waco 10's. OX-5 and OXX-6. Both ships in perfect shape. New covering, new prop, air wheels, air speed, bank and turn, plus standard instruments. Low hours on motors. Want Waco F or F-2. Will accept late model car. Max F. Smith, 103 N. Third St., Clearfield, Penna.

WACO S-6, JACOBS: Battery ignition (without flaps); licensed until March 1938. Cruises 133, top 150. Wood propeller. Color: solid vermilion, blue leather upholstery. Extra equipment includes hand-rubbed high gloss finish on wings and fuselage; airline type Lux fire extinguisher, connected with entire engine compartment and carburetor, also hand Lux and Fyrene; Crosley two-band beacon receiver with static-proof antennae; bank and turn, rate climb; three electric 1½ minute flares; retractable landing lights, position lights; tie down rings; lighted instrument panel, luminous dials; bonded, shielded; oversize tires. Licensed for four people; can be licensed for five. Total time 100 hours; perfect mechanically and in appearance. Guaranteed never cracked up, scratched or even ground looped. Purchased new from factory, April 1936; would cost new today about $7,000. Cash price, $4,700. Will deliver free east of Mississippi for gasoline cost. Can be seen any time, State Airport, Hillsgrove, R. I. Write Edward Bullard, Pomfret, Connecticut.

1936 WACO CUSTOM: NC16520; 285 hp Wright motor. Controllable propeller, turn and bank, rate of climb, flares, landing lights, RCA receiver, clock, thermocouple, manifold pressure gauge, carburetor temperature gauge, cactus-proof tires; special Diana cream with blue striping. Beautifully finished throughout. Total time 83 hours. Like new. $6,500. AERO DIGEST, Box 2616.

TWO OX WACOS: Model GXE in excellent flying condition, recently recovered; fabric perfect; 30 x 5 wheels, brand new Flottorp propeller. $200 down, balance financed. Central Air Service, Grand Rapids, Michigan.

WACO C: 1932 cabin, perfect condition throughout. Heywood starter, standard instruments. Total time on airplane, 815 hours. Engine, 875 hours. Since overhaul, 20 hours. Finance 50%. $2,200. John T. Corrodi, Inc., Box 185, Bexley Station, Columbus, Ohio.

## *Miscellaneous Aircraft*

FOR SALE or Trade: Terms. J-5 Cessna, Warner Cessna, Siemens Waco, J-4 Laird, LeBlond Davis, J6-5 Travel Air, OX Waco. Alford Flying Service, LaGrange, Illinois.

FOR SALE: J-5 Travel Air, perfect. One OX-5 Travel Air. One OX-5 Command-Aire. One Kinner American Eagle. DeYoung & Garret Flying School, Grand Prairie, Texas.

AIRPLANES, motors, crack-ups, OX-5 ships, $90 up. Terms. Complete Directory with full descriptions, owner's price, name and address, 25¢ postpaid. Used Aircraft Directory, Athens, Ohio.

KINNER WACO F: Ship and motor excellent condition. 530 hours total time. OX American Eagle, in good flying condition, $250. Everett S. Cox, R.R. 3, Winchester, Indiana.

FAIRCHILD '24': Ranger, late 1935; rate of climb, bank and turn, flaps, landing lights, RCA radio, generator, pants, etc.; $3,200. Aeronca low wing: 90 hp Warner, built June '36; electric starter, flaps, navigation lights, etc., total time 150 hours; $2,500. Waco cabin, Continental, 1933; total time 378 hours, 30 hours since overhaul; starter, air brakes, pants, dual wheels, etc.; $2,400. Air Service, Inc., New Castle, Delaware.

'33 AND '34 STINSON RELIANTS; '36 Lambert Monocoupe; 3-place Warner Fairchild; Bellanca Skyrocket; Rearwin Sportster, new, 85 LeBlond; 225 Jacobs Beechcraft; 420 Wright Beechcraft; Lockheed Vega; Lockheed Electra; Douglas Dolphin; 145 Luscombe; S-39 Sikorsky. Aircraft Sales Co., Hangar D, Roosevelt Field, Mineola, New York.

PORTERFIELD LE BLOND 70: Travel Air J6-5; Waco OX-5; Command-Aire OX-5. All licensed and in excellent condition. Gloversville Airport, Gloversville, New York.

WACO C: 165 Continental; 1933 cabin four-place biplane; licensed to April 1938; $1,750. Stinson 1934 SR-5 with flaps, 300 hours; like new, just licensed; $3,600. Waco J6-5 biplane, just licensed, $1,100. Waco 10, $450. Eaglerock OX-5, $450. Fairchild 5-place four longeron monoplane, $1,000. C-3 Aeronca, $775. Cunningham Hall J6-9 six-place cabin biplane, $2,000. All of the above airplanes purchasable with 25% down payment and balance financed by us. (Act quickly, if interested). Also Lycoming, just majored R-680; Continental A-40-2; Cirrus; Hisso; Kinner K-5 and OX-5 motors. New Russell 24-foot silk parachute and parts for Robin, Cub, Ryan, Avian and Stinson Reliant airplanes; also steel propeller. (Taylor Cubs E-2 and J-2 models, $700 to $1,000). All motors and parts purchasable on the finance plan with no down payment. Pictures and information on airplanes sent you cheerfully on request. Aviation Finance Company, Hemlock, N. Y.

WE OWN AND OFFER for sale or trade: Wasp Flamingo, just majored and relicensed. Complete night and blind flying equipment; $2,200. Kinner American Eagle: Landing lights, steel prop; licensed; $675. Challenger Robin: Excellent condition throughout; low time. New Porterfields and Zephyrs. Currey Airplane Sales Company, 221 North 12th Street, Monmouth, Illinois.

WACO F; Fleet; Verville; Porterfield; Stearman 4-D; OX-5 Waco; Cub. American Cirrus and Lycoming R-680 parts. Trades and terms. Aero-Ways, Inc., Cleveland Airport, Cleveland, Ohio.

'35 STINSON RELIANT: Many extras. Model 7 Fleet, recovered. LeBlond 8500 Rearwin, many extras; 6 months old. J-5 6-place Stinson, excellent condition. Stinson U Trimotor, radio and many extras. OXX Challenger airplane. All airplanes priced to sell and in excellent condition. Akron Airways, Airport, Akron, Ohio.

20 CERTIFIED AND RECONDITIONED airplanes, for sale or exchange: Lambert 90 Monocoupe; Warner 145 hp Monocoupe, late model; J-5 Speedwing Travel Air; B-5 330 hp 6-place Ryan; J-5 220 hp 3-place Laird; J6-9 330 hp 6-place Stinson; PA-8 Pitcairn Mailwing, less 330 hp motor; two OX-5 Waco 90's; two OX-5 Travel Airs; Lycoming powered Stinson Jr., equipped for night flying; Challenger powered Travel Air, very clean; J6-7 250 hp 3-place Travel Air; J6-9 330 hp 6-place Travel Air; OX-5 Robin; J-5 6-place Stinson; OX-5 Laird; J-5 220 hp Straightwing Waco. Late model cars accepted. Becker-Forner Flying Service, Inc., Jackson, Michigan.

ENTHUSIASTIC 1937 Arrow Sport V-8 owner reports $2.10 spent for parts in 75 hours of faultless operation. Operators investigate! G. D. Kelsey, Municipal Airport, Philadelphia, Pennsylvania.

REPOSSESSED AIRPLANES: Robins, $875. J6-5 Stinson, $950. Aeronca, $695. Birds, $850. Monocoupe, $495. Lycoming Stinson, $1,300. Cub, $600. OXX-6 Robin, $500. J6-5 Travel Air, $1,100. Warner Stinson, $850. Warner Monosport, $950. Waco, $350. Eastman Flying Boat, $1,500. J6-5 Aristocrat, $875. J-5 Travel Air, $1,100. Beechcraft, $4,800. Pioneer offers the best at lowest prices. Investigate our reliability. Pioneer Aero Brokerage, Airport, Syracuse, New York.

FAIRCHILD KR-31: Perfect shape. Best stunting OX around. Licensed; $345. J-5 CA Stinson 5 biplane: Steel prop; good load carrier; best cash on motor or ship. Heath LNB4, unassembled, with motor. Licensable; $135. Velie Monocoupe, $395. Le North Air Service, Linden, New Jersey.

AERONCA 1935; Aeronca 1933; Aeronca 1932; Stinson SM2AB; Rover Driggs; Waco F, Warner; Lambert Monocoupe; OX-5 Travel Air. All ships licensed and in first class condition. Air Activities Airport, West Chicago, Illinois.

FOR SALE OR EXCHANGE: Two Wright J6-9 Stinsons, 6-place. Two Driggs Skylarks, one nearly new. Two J-5 Travel Airs. J-5 Waco; two OX-5 Wacos. Combination wing Eaglerock. Can finance up to 50%. Automobiles or airplanes accepted in trade. Write for details. Central Air Service, Inc., Grand Rapids, Michigan.

REPOSSESSED B-1 RYAN cabin ship, less motor. Price, $450. Repossessed J-5 6-place Stinson cabin ship; price, $550. Repossessed 330 hp Stinson, with or without motor. Make offer with or without motor. Bargain prices. Edw. A. Forner, Jackson, Michigan.

WARNER ROBIN: Licensed, new covering; pay load 442 lbs., A-1, $795. C-3 Aeronca, E-113-C motor; just majored; licensed April 1938; $650. O. Dickerhoof, Chanute, Kansas.

CUB, LATE '35: A-40-3 motor. Aircraft battery, lights, special paint; $800. Relicensed Challenger Robin, excellent condition, $750. Fly either anywhere for expenses. Jimmy Sproule, Municipal Airport, Toledo, Ohio.

## ENGINES

FOR SALE: 125 hp Warner, less than 500 hours. Price $500 plus crating charges. P. H. Pedrick, 480 May Street, Jacksonville, Florida.

PRATT & WHITNEY HORNET: Complete, $350. Rising Sun Motors, 860 East Luzerne Street, Philadelphia, Pennsylvania.

DH GIPSY: 780 hours; 50 since major. $165. Set 22 x 10 x 4 Airwheels, complete, $30. W. Falck, 116 East 127th Street, New York, N. Y.

MOTORS! MOTORS! MOTORS! Two J6-9 E-type 330 hp motors. Two J-4 220 hp motors. Two J6-9 330 D-type motors. J-5 220 hp motor. These motors are all in running condition, priced to sell. Starters and propellers for above motors, if desired. Also slew of motor and aircraft parts at closing-out prices. Michigan Aero Motors, Jackson, Michigan.

LYCOMING MOTORS: Model R-680-4. 225 hp. Less than 200 hours total time. Model R-690, 215 hp. Write for prices and details. Chicago Aviation Corporation, Glenview, Illinois.

LYCOMING R-680: Any part for Lycoming, cheap. Want Warner 125 hp engine. Hal Knoche, 710 Richards Road, Municipal Airport, Kansas City, Missouri.

## WANTED TO BUY OR TRADE

WANTED: Good used Scintilla magneto and mount, if different from Berling mount; or used Berling magneto at reasonable price for OX-5. Evan McCrory, 2052 Ohio Avenue, Connersville, Indiana.

WANTED: Pair of pontoons, complete, for low wing Aeronca or Waco. Or, low wing Aeronca or Waco with pontoons. Give price and full details. AERO DIGEST, Box 2590.

WANTED TO BUY or charter: Seaplane, amphibion, or ship on floats. Must be 2-4 place, new condition. S. Morgan Barber, Jr., Greens Farms, Connecticut.

WILL PAY UP TO $2,000 cash for best 4-place cabin plane, Stinson preferred. State actual time and condition in detail. AERO DIGEST, Box 2592.

WANTED: B-5 125 hp Kinner motor, front exhaust; any condition. Also complete landing gear, struts, etc., for equipping a Model 7 de luxe Fleet with brakes. Advise all details first letter. Buffalo Aeronautical Corporation, Buffalo Municipal Airport, Buffalo, New York.

WANTED TO BUY Ryan ST. Must be in good condition; send full details and lowest price. AERO DIGEST, Box 2596.

WANTED: Arrow Sport "66" or Inland Sport, Kari-Keen, or any good 2-place side-by-side open or closed ship. Write Box 12, Cedar Rapids, Iowa.

WANT LAMBERT 90 engine or any engine to fit same mount on Lambert Monocoupe. Or, Lambert rods, pistons, barrels. Russell Karels, Regina, Sask., Canada.

WANT TO TRADE exceptionally good 1936 high wing Aeronca, licensed to April 1938 on 1933 Waco cabin needing motor overhaul and recover job. M. J. Ernst, Box 237, Chambersburg, Penna.

WANTED: J-5 Fledgling; state color, condition of plane, motor, hours, instruments, duals, brakes, fabric. Cash sale. Will consider Challenger Fledgling also. Want two seat-pack Irving chutes. State factory sale date. Write Box 8963, West Palm Beach, Florida.

WANT: Lambert engine and propeller. Will consider any 75-110 hp radial if price condition appeals. Have Velie crankshaft, $40. John Wright, Reed College, Portland, Oregon.

WANTED: Licensed 3-place open J-5 Waco, Travel Air, Stearman or similar ship. Give full details and lowest cash price in first letter. E. B. Votaw, care City Hall, Beaumont, Texas.

PRACTICALLY NEW '37 de luxe Lafayette Sedan, many extras; trade for 6000 Travel Air, Cessna, '37 Aeronca or Taylorcraft. Ship must be licensed and in perfect condition. AERO DIGEST, Box 2602.

WANTED: Continental A-40-3 or Aeromarine AR-3-40 engine. Give full particulars first letter. R. Tyce, Chula Vista, California.

WANTED: Small licensed cabin ship, cruising 110 or better, such as Warner Monocoupe. Must be bargain, for cash. Ralph Schmitt, 1211 S. Vandeventer, St. Louis, Missouri.

TRADE: J6-7 TRAVEL AIR 4-D biplane. Complete with starter, tailwheel, inverted flight gas system, ring and cockpit cover. Plane, motor and prop 50 hours since overhaul. Desire to trade for J-5 Standard or late type J-5 Travel Air. Boulevard Airport, Roosevelt Boulevard, Philadelphia, Penna.

MOTOR BOAT RUNABOUT: 30 foot; 7-foot beam. Seats 10. Fully equipped; even has trailer. Gray marine motor. 100 hp. 75 hours. Sell or trade for light plane. Ward Soanes, 907 Amherst Street, Buffalo, New York.

WANTED: All type airplanes. If your plane is for sale, send it to "Pioneer". Over 95% are sold within 30 days. Free storage. Wire, write. Largest used dealer in U. S. A. Pioneer Aero Brokerage, Airport, Syracuse, New York.

TRADE: Wright J6-7 engine, complete with Hamilton steel prop; both 50 hours since complete overhaul, for Wright J-5 and prop in good condition. Also detachable Travel Air biplane J6-7 motor mount and oil tank for one fitting J-5. Boulevard Airport, Roosevelt Boulevard, Philadelphia, Penna.

## MISCELLANEOUS PRODUCTS AND EQUIPMENT

BROTHER, CAN YOU SPARE a dime? If you can, send it to me and I'll send you my Low-Priced Aviation Material Catalog. (Canada 20c). Karl Ort, 625 W. Poplar, York, Penna.

FOR SALE: R C A radio receiver, model AVR-7, new condition, used very little. The first $60 takes it. Bob Allen, Walters, Oklahoma.

FLYING EXPERIMENTAL KIT: Contains materials for airplanes, directions for indoor flying. Harmless. Guaranteed. All for $1. Alexander F. Kolinski, 1965 S. Muskego Avenue, Milwaukee, Wisconsin.

RCA SOUND EQUIPMENT: 20-watt power amplifier, complete with turntable phonograph and Philco radio attached, portable mike, stand mike same as used in broadcasting studios, two loudspeakers. Excellent for flying fields. Cost $550 and used one month, trying to elect that man Landon—remember? Will sell the headache for $300—no dickering. Victor F. Sheronas, 123 South Broad Street, Philadelphia, Pennsylvania.

INSTRUMENTS: Large turns, climbs, $45 apiece. Small turns, climbs, $30 apiece. Altimeters, Kollsman, $6; tachometers, $6; Pathfinder compass, new, $10. Engines, J6-7, just majored, modernized clutch, $495. Radio beam receiver, $10; headphones, $1. Starter, Heywood, 7 cyl., $40. Tires, used, 8.50 x 10, $10. Buck, 409 N. Francis, Madison, Wisconsin.

UPPER WING PANELS and tail section for DH American Moth. Will sell covered or uncovered. Priced reasonably. M. J. Ernst, Box 237, Chambersburg, Penna.

FOR SALE: Parts for Kinner and Warner engines. Special prices on valve guides and rocker arm bushings. Everything for the airplane. Write us for prices on any of your requirements. Ames Aircraft Supply Co., Box 263, Niles, Michigan.

ENGINE PARTS: Kinner K-5 master rod and crankshaft; J-5 master rod and bearing; J6-9 induction housing; Warner induction housings and main case; Velie M-5 main case and cylinders; LeBlond 7-cylinder main case and crankshaft (less than 20 hours' use); valve guides for Kinner K-5, B-5, English and American Cirrus; Warner engines; Kinner K-5, B-5 valve seats; gaskets; rings. Snyder Aircraft Company, Municipal Airport, Chicago, Ill.

FOR SALE: Landing gear parts for Travel Air 2000. Also struts, flying wires. New and used. Used J-6 crankshaft and other parts. Amsterdam Flying Service, Inc., Amsterdam, New York.

ELECTRIC ARC WELDERS: 110-220 AC acetylene welding equipment. Easy payments. Box 331, Hamilton, Ohio.

COMPLETE SET J-5 cylinders, used only 35 hours, guaranteed: $98.50 or $12.50 each. New Thompson exhaust valves, $5. Scintilla mags. $15. Complete parts for J-5, low priced. AERO DIGEST, Box 2610.

FLIGHTEX sewn-up slip-on covers for all airplanes. Licensed cable splicing; nitrate dope or thinner, $1.25 a gallon. Wanted: 3POLB. Surplus aero materials. Ostergaard Aircraft, Dunning, Chicago, Illinois.

NEW PIONEER rate of climb and bank and turn; $50 each. J6-9 Scintilla magneto, overhauled, $25. Irving seat pack, 24 feet, like new, $60. Box 609, Shreveport, Louisiana.

STINSON S PARTS: Complete landing gear; 8.50-10 semi-airwheels, full pants and fully faired, $175. Tail wheel assembly complete, $25. Struts, wing compression and nose ribs, tail surfaces, set Ryan-Lite retractable landing lights; Lycoming R-680 (less mags, starter and carburetor) with heavy duty crankshaft and forged pistons; Hamilton Standard prop; full exhaust manifold, shutters and ring; $200. Southern Airways of Danville, Inc., Box 205, Danville, Virginia.

FOR SALE: Wiley flares, reconditioned, $15 each. Complete Wright J-5 crankcase. J-5 steel propeller. J6-5 steel propeller. J6-7-E exhaust collector. J6-9-D rear section. Overhauled OX-5 engine. Complete stock of Challenger engine parts, at very low prices. Get our prices before ordering. Aviation Associates, Inc., Curtiss Airport, East St. Louis, Illinois.

ONE PAIR upper panels for 2000 Travel Air; one pair 650 x 10 tires and tubes, used; one pair 22 x 10-4 Goodyear Airwheel tires and tubes, used. John T. Corrodi, Inc., Box 185, Bexley Station, Columbus, Ohio.

OVERHAULED MOTORS & Parts: J-5, Challenger, Siemens-Halske, LeBlond, Hisso, Comet. Wings: Travel Air, American Eagle. Reconditioned Standard Steel and wood propellers, any size, $15—$75. Reconditioned Hamilton controllable Wasp propeller. Brand new Curtiss Reed propellers at discount. Heywood, other, starters. Travel Air fuselage, stressed 220 hp. Dope, 80¢ gallon. Convert your OX job. We have approved motors and mounts ready to install: Challenger Robin; Challenger, Siemens Travel Air; Siemens Waco. Also Warner Robin, J6-5 Travel Air; approved mounts. Miller Flying Service, Montclair, New Jersey.

STINSON TRIMOTOR U and T parts: Pilgrim parts; Hamilton Standard adjustable propellers and hubs, 165 hp and up; Great Lakes Trainer wood propellers: magnetos, carburetors and starters for J-5, J-6, Wasp, Hornet and Cyclone; Wiley three-minute flares; switches; tail wheels and tires; gas and oil tanks; chairs; J-5 cylinders; J-6 parts; miscellaneous parts. General Airmotive Corporation, Municipal Airport, Cleveland, Ohio.

2¼" FLIGHTEX pinked tape, 100 yard rolls, $2.25. Flightex fabric, best quality, 35¢ per yard. Good quality pinked 2¼" tape, $3 per 200 yard roll. B. G. 4B-2 spark plugs, 75¢ each. B. G. plugs, 50¢ each. 24 x 4, 26 x 5, 28 x 4 straight side non-skid cord casings, $3 each. 700 x 4 tires and tubes, $12 each. 29 x 13.5 tires and tubes, $35 each. Best quality 120 lb. oil gauges, 60¢ each. Sheet dural, 21" x 180", 28 and 30-gauge. Sheet dural, 3' x 12', 4' x 12', 6-to 14-gauge, 15" x 120", all new, 24 ST. 55¢ per lb., discount for large quantities. 500 x 3, 500 x 4, 300 x 8, 14 x 3 tires, $5 each. 16 x 4 non-skid tires, tube and wheel, $10.50; tailwheels, $4.50 and $5 complete. Tachometers, $5 each, all makes. Streamlined 13-volt, 32 ampere generator, with voltage regulator, $6.50 each. Wasp and Hornet C and parts for all makes of motors at exceptionally low prices. All items advertised are new. Crawford Airplane Supply Company, Venice, California.

## POSITIONS WANTED

TRANSPORT PILOT: 750 hours; 30 hours instrument and radio time; 1A and 2A ratings; college graduate; age 24, single. Desire connection with reliable company or individual. Will go anywhere. Excellent references. AERO DIGEST, Box 2593.

TRANSPORT PILOT: 27, single, 9 years broad flying experience. 2800 hours all types, 600 hours night, 200 hours on instruments. S.A.T.R. rating. Reliable, energetic, thoroughly competent. Neat appearance, good personality. Successful instructor. Speak Spanish. Highest references. Now flying for Weather Bureau. Services available July first. AERO DIGEST, Box 2594.

TRANSPORT PILOT: Single, does not smoke or drink; all business. 1, 1A, 2A ratings. 8 years' passenger and instructing. What have you to offer me? AERO DIGEST, Box 2611.

LICENSED A & E MECHANIC: Technical training, graduate U. S. Government Approved mechanic's school; desires private or commercial employment in any capacity. E. A. Erickson, 2537 Eastwood Avenue, Chicago, Illinois.

## MISCELLANEOUS SERVICES OPPORTUNITIES, OFFERS, ETC.

WANTED: Girl parachute jumper, with chute. OX-5 recovered Eaglerock for sale; $390. Robert Koleman, Stickney Avenue Airport, Toledo, Ohio.

WANTED: CAPITAL for manufacture of two-place tandem cabin monoplane, to sell for $1,200 or less. Description: wing span, 32'; length 23'; inverted in line; 4-cylinder; liquid cooled; 60 hp at 1650 rpm. This is NOT a converted automobile engine. Individual doors for pilot and passenger. Landing speed, 35 mph. High speed, 110 mph. Weight empty, 650 lbs. Useful load, 500 lbs. AERO DIGEST, Box 2599.

THE BENNETT PLAN places new airplanes in operation for you. Ideal for flying clubs or individual wishing to start flying business. Little or no capital necessary. Write Bennett Air Service, Box 247, Hightstown, New Jersey.

AMBITIOUS YOUNG MAN wants company or person to finance him through transport or test pilot's course. AERO DIGEST, Box 2612.

REARWIN AGENCY available for Minnesota. Make money selling Rearwins, leader in $1,800 to $5,000 price class. Write or wire Rearwin Airplanes, Inc., Fairfax Airport, Kansas City, Kansas.

FLYING JOBS WAITING for our graduates. Need more men. Commercial course only $290. Free booklet. We use new airplanes for training. Bennett Air Service, Hightstown, New Jersey.

JOBS FLYING Multi-engined airplane to two young men who will take complete transport course with us. Must be willing to work to learn the business from the ground up. Akron Airways, Airport, Akron, Ohio.

LEARN FLYING FOR FUN: Become competent pilot during leisure time. Lesson each week at $2.50. Solo course, $50. New airplanes, expert instructors. Quaker City bus, direct from New York or Philadelphia Bennett Air Service, Airport 4 miles south of Hightstown, New Jersey. Free booklet.

## HELP WANTED

AERONAUTICAL ENGINEER. Experienced engineer with record of executive and design ability. Must be familiar with Army requirements, modern construction and good knowledge of aerodynamics. State education and full experience details, salary, etc. AERO DIGEST Box 2597.

AIRPLANE SALESMAN: With experience and transportation, to handle exclusive state territory. Commission basis. Wonderful opportunity. (Flying experience not essential). Executive experience and reference required. AERO DIGEST, Box 2614.

INSTRUCTORS for large government approved ground school, qualified to teach Aeronautical Engineering and Mechanics subjects. Give experience, training and enclose snapshot of yourself. Reply AERO DIGEST, Box 2615.

APPROVED GROUND SCHOOL Instructor, with A&E license, who has had many years experience in practical service work, specializing in motors. Must be capable of handling students and taking complete charge of motor repair station when necessary. Write giving full details and references in first letter. AERO DIGEST, Box 2617.

## PARACHUTES FOR SALE

PARACHUTES: Irving and Switlik chutes, new and used. Wanted at all times used parachutes for cash. Describe fully. Air thrillers for airports, celebrations, etc. Thompson Bros. Balloon & Parachute Co., Aurora, Illinois. Established 1903.

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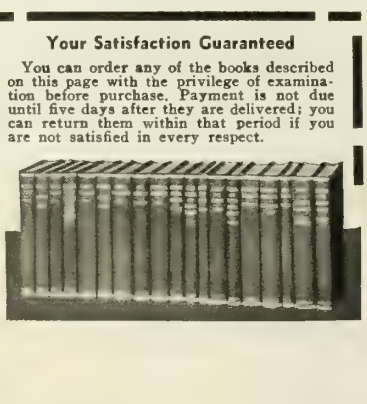
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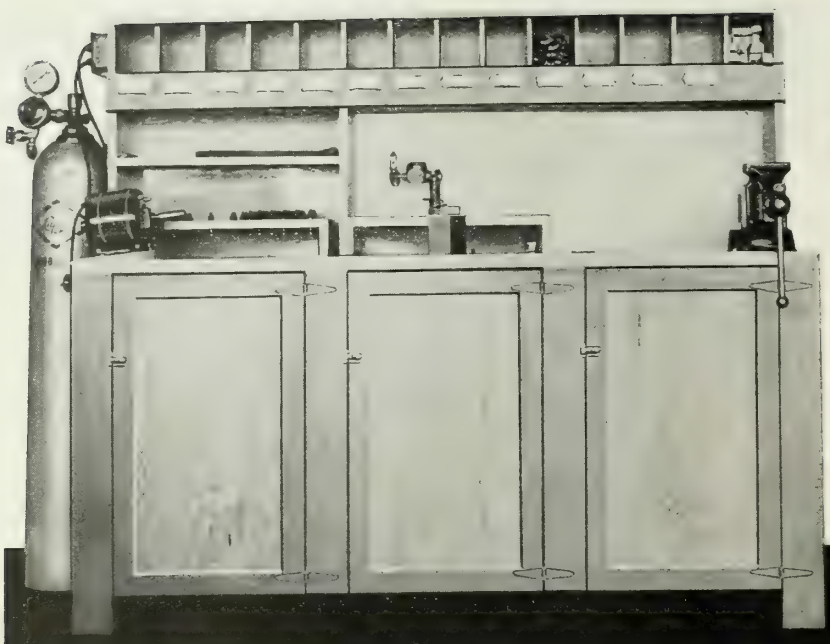
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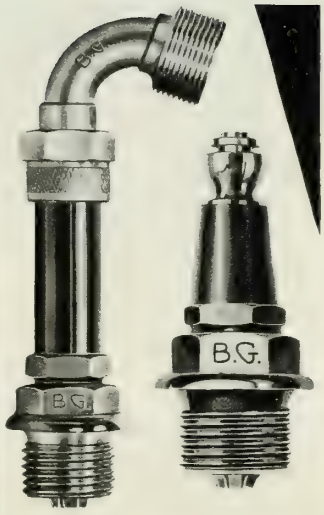
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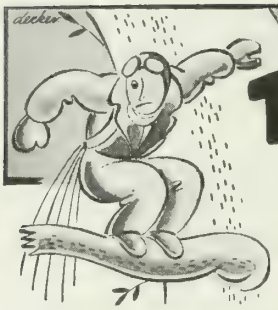
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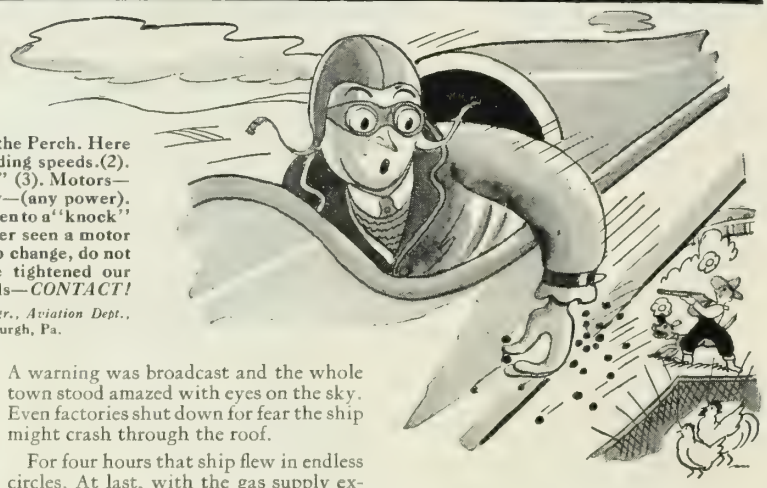

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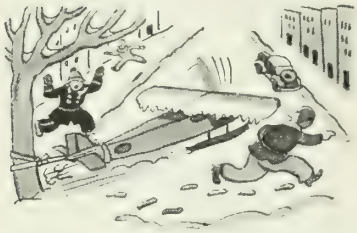
# The Birdmen's Perch



**I've been asked for specifications on yarns for the Perch. Here they are: (1). If home-made—no limits to landing speeds.(2). Stock models—all landings with wheels "up." (3). Motors—Real and Imaginary Aircraft Engine Company—(any power). (4). Any fuel below 40 octane—so that we can listen to a "knock" once-in-a-while. (Get me?) (5). If you have ever seen a motor of a plane or anything else you did not want to change, do not fill in entry blank. (Got me?) (6). We have tightened our helmets and goggles and removed windshields—*CONTACT!***

MAJOR AL WILLIAMS, alias "Tattered Wing-Tips," *Mgr., Aviation Dept.*, Gulf Aviation Products, Gulf Building, Pittsburgh, Pa.

## CRAZY GUY FROM THE NORTH CONTREE!



A few months ago a well-known Saskatchewan airman was hauled up in court.

The judge handed him out a fine for obstructing *pedestrian* traffic on one of the principal streets of Regina. The birdman, you see, had landed at the airport and, feeling lazy, just taxied on skiis down the snow-covered streets of Regina.

Since Regina is no one-horse town but a city of 50,000, you can see that the lad had his nerve to use the streets for an airplane boulevard.

The officer who arrested him said that the motor was running *and the plane was tied to a tree*. Since he had to tie the crate up, I figured he must have been using Gulf Aviation Gas—and that you would like to hear about the story.

**—Jim Miller, Bladworth, Sask., Canada**

## STRANGE HOBBY DEPARTMENT

(Excerpt from the July Perch)

"A pilot I nominate for immortalization is 'Spike' Callahan. 'Spike' washes dishes for a living and, in his spare time, flies.

"*Is it hard to get their ears clean, 'Spike'?*"

**—H. L. L.**

## IS S. M. PULLING OUR LEG?

This pilot (whose name I'd like to know) was cruising over a small town when his engine caught fire.

Having no fire extinguisher, he bailed out. When he reached the ground, he found to his surprise that the fire had gone out and that the ship was flying in circles.

A warning was broadcast and the whole town stood amazed with eyes on the sky. Even factories shut down for fear the ship might crash through the roof.

For four hours that ship flew in endless circles. At last, with the gas supply exhausted the ship started on a downward course. And, believe it or not, that plane landed "dead stick" in an open field. It had a washed out landing gear and a smashed prop.

This incident, I believe, took place somewhere in California. Can some one verify it for me?

**—S. M., Shillington, Pa.**

## THE EDITOR'S NEW BABY



Here's Al Williams' new Grumman G-22, powered with a 1000 h.p. Wright Cyclone engine. Besides plain and fancy flying, Al will use this ship to test Gulf's new *Airline Oil*.

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## THIS MONTH'S WHOPPER

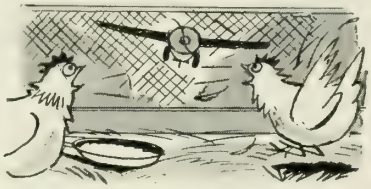
Out in Joliet, the bumble-bees are made of lead. I know, because I caught one in my hand. It was like this.

One day I was up in my plane, just horsing around, when I happened to pass over a chicken farm. Now, I love chickens.



I think they're man's best friend, especially with gravy. So I swooped down low just to say hello to the biddies.

Trouble was, I got too low. So low that the fowl belles got scared and set up a terrible cluck-cluck-cadockit.



The farmer ran out with a shot gun, and I vamoosed.

Then, something funny happened. I looked out the side of the cockpit and saw a swarm of bees. They were going along at the same rate of speed that I was traveling.

Being curious, I put on a glove, reached out and grabbed a handful. Was I surprised to find that I had a handful of buckshot.

With that Gulf Aviation Gas I was using, the speed of my old Jenny was exactly the speed of the buckshot.

**—"Chuck" Winston, Joliet, Illinois**

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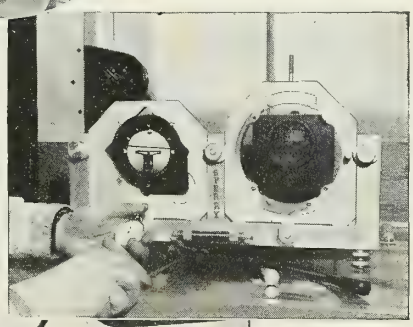
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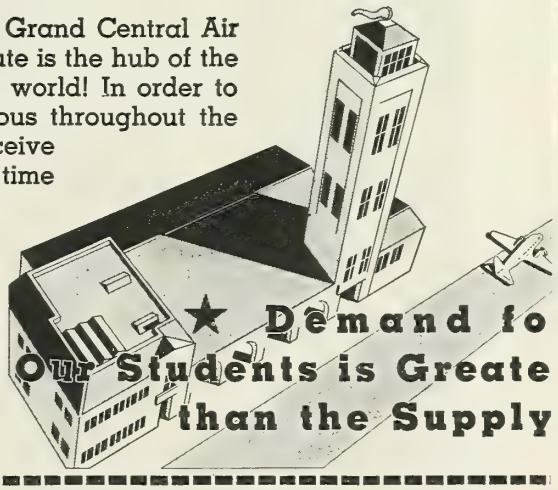
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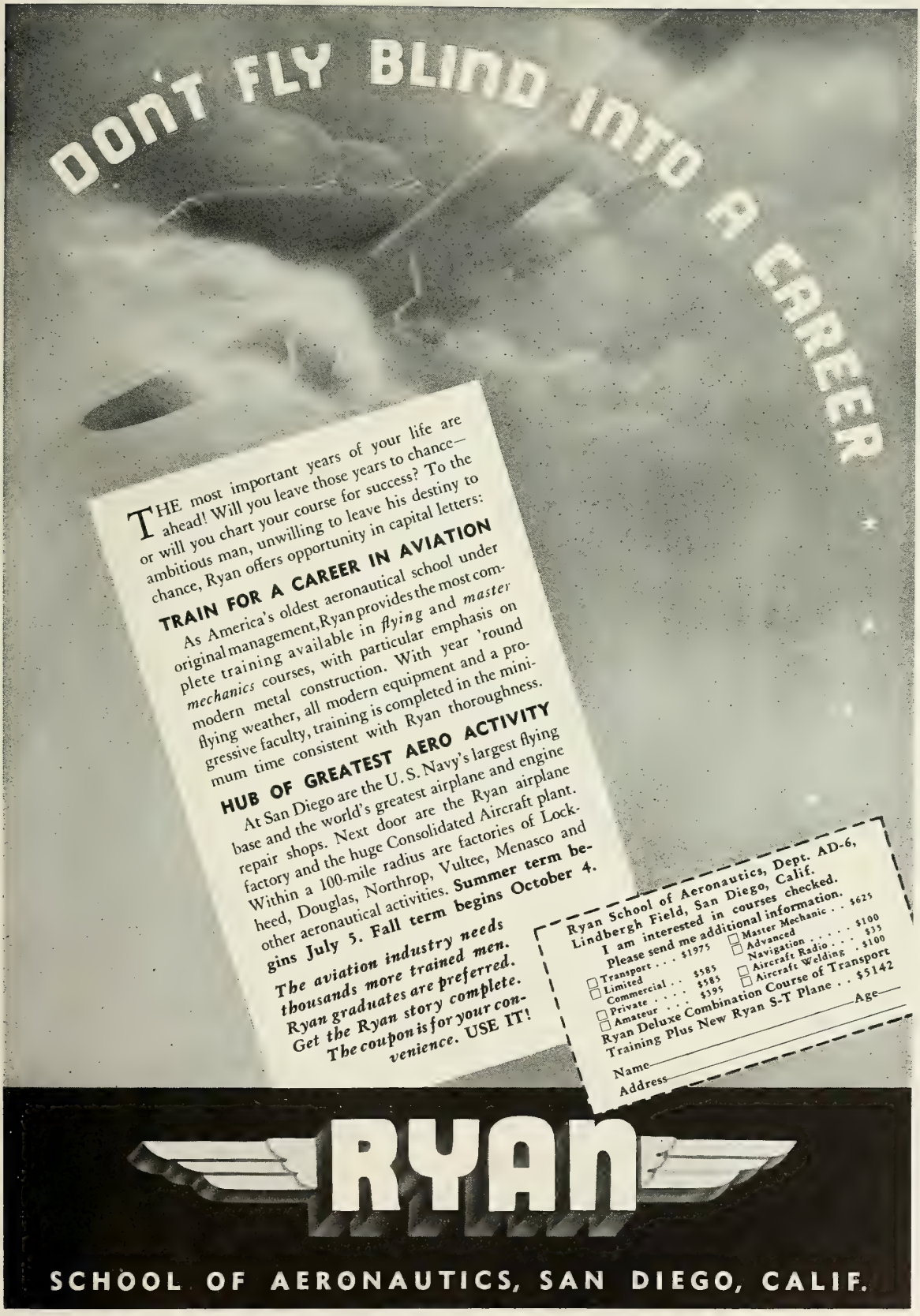
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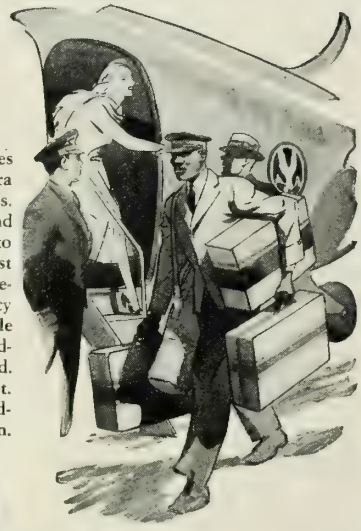
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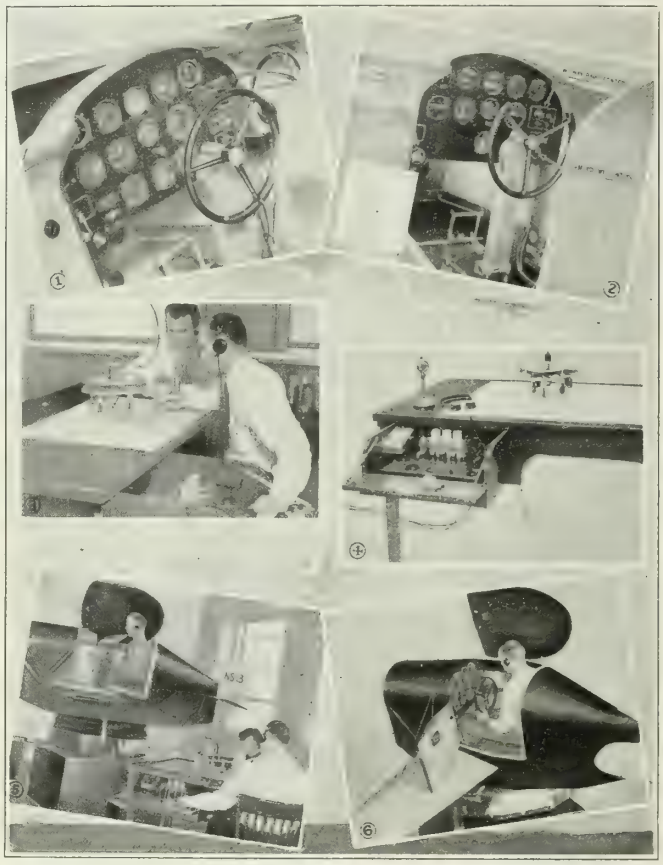



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*1. Instrument panel of Link Trainer. 2. Panel showing location of principal instruments. 3. Instructor explaining problem to student. 4. Instructor's desk showing radio equipment, recorder and chart. 5. The Trainer showing student and instructors. 6. Student in cockpit of Trainer.*

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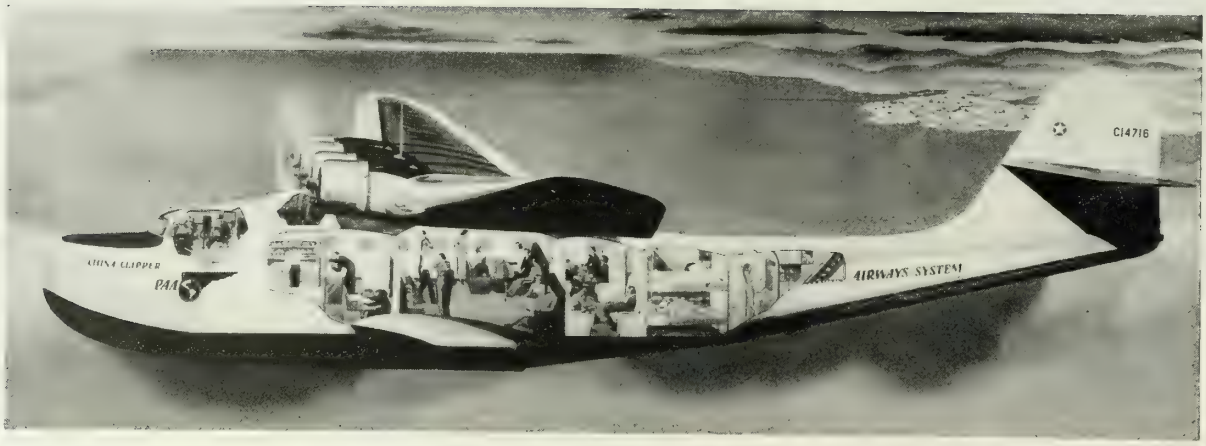

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## TRANSPACIFIC OPERATIONS ON PAN AMERICAN AIRWAYS



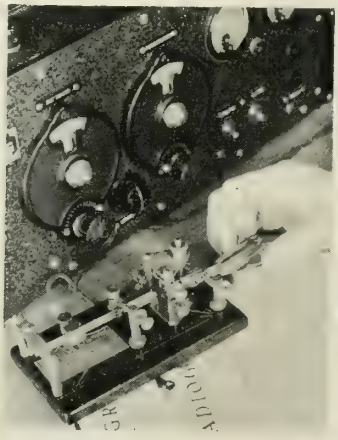


Two years of flying the Pacific Ocean has made it a routine procedure to the Pan American Airways' personnel. Captain and First Officer shown at controls while the Radio Officer listens in on the radio beam. The flight Engineer is in touch with the pilots by phone





Octant observations during flight are checked with position reports transmitted to the Clipper planes by radio. Planes are constantly in touch with shore stations by means of special long-range radio developed especially for and installed in all Pan American planes



# PIONEERING IN OCEAN AIR TRANSPORT



● There is a tendency in this country—at least in that part east of Salt Lake City—to think of ocean air transport almost exclusively in terms of the Atlantic. When editorial writers do a piece on the airplane's achievement of the ability to cross the ocean on commercial schedules, "the ocean" isn't just any big stretch of open sea but is definitely the North Atlantic—specifically the route in mind is one between the general regions of New York City and the southern end of the English Channel. And there is no questioning the fact that this particular passage enjoys the greatest prestige of all the world's trade routes, has perhaps the greatest international traffic potentialities for any transport form. The history of ocean-borne commerce fixed that by developing first in the Mediterranean, spreading across the Atlantic and then taking up the "conquest" of the Pacific as a sort of afterthought.

But before our attention gets permanently fixed on the Atlantic project, let's get it set in our minds that the first full scale pioneering in ocean air transport got underway almost a decade ago in the Caribbean, and that the present stages of the North Atlantic campaign were passed through in the Pacific in the early months of 1935. By the time this is being read, Pan American and Imperial Airways will be well embarked on the "flying in" of services they are soon to open to Bermuda. Soon after, both companies will begin survey flights on routes projected on the full Atlantic crossing. How sound will these efforts be? What will be their basic pattern? Will they show any methods of approach to the problem new since the opening of Pan American's attack on the Pacific crossing? Our answers lie obviously in the record-to-date of the Pacific operation.

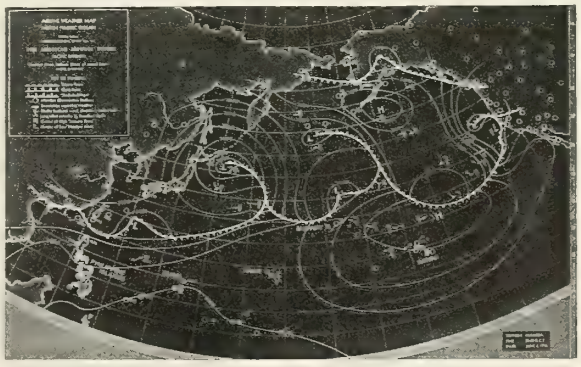
The public and the general aeronautical industry are already familiar with most of the high spots of the Pacific development: The first "colonizing" expedition of the steamer *North Haven* (March-June, 1935) that built the bases at Midway, Wake and Guam and carried supplies for terminals at Honolulu and Manila. The four trail-blazing survey flights of the Sikorsky S42, *Pan American Clipper*, in the spring and summer of 1935 and round trips to Hawaii, to Midway, to Wake, finally to Guam. The air mail inaugural by the Martin 130 *China Clipper* November 22, of that year. The passenger inaugural in October, 1936. The survey flight to New Zealand this March. The final closing of the Manila-Hong Kong gap two months ago.

The story of the five years of elaborate preparations that antedated even the first trail-blazing flights is also a rather well known story, but we rehearse it briefly here. By 1930 Pan American Airways, with the encouragement and assistance of the Post Office Department, had succeeded in forestalling the threat to American commerce of European dominance of Latin American air routes. Already, however, Great Britain, France and Holland were thrusting out trunk airlines across Asia Minor toward China and Eastern Asia—a market of an importance to our foreign trade equal to that of Latin America. Such airlines would bring that market within a week or ten days of Europe, while we would still be three weeks away by steamer. The only answer possible was an American air route to the same area.

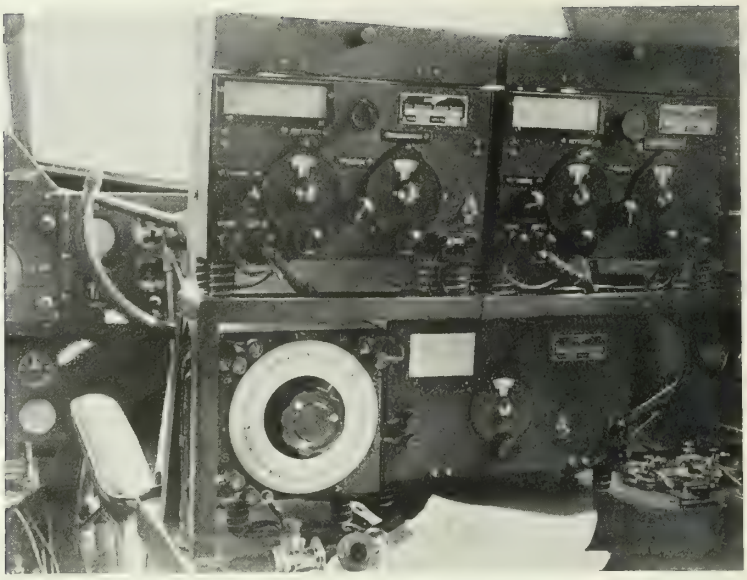
By far the most practical American route between the United States and China lay directly across 9000 miles of the Pacific Ocean—a 9000 miles broken into comparatively flyable distances by the islands of Hawaii, Midway, Wake, Guam and the Philippines. The prime task from an operations point of view would be posed by the 2410-mile stretch between California and Honolulu—a distance, incidentally, 400 miles greater than the corresponding "control" hops in the Atlantic between either Bermuda and the Azores or Newfoundland and Ireland.

Seven years ago there was little in the way of precedent for the planners of such a project. Not only would strategy and tactics have to be worked out, but new weapons and a new type of man-power had to be developed for such a campaign. In truth, there existed at that time, no airplanes which came even approximately close to the obvious specifications of being able to make a 2410-mile crossing with ample fuel reserve and a commercially





*Pan American Airways' direction finder station at Alameda, and a typical airline weather map of the North Pacific*



*Radio equipment aboard the "China Clipper," and at a ground station*



practical payload. No men had ever been prepared for such a task as the routine flying of transoceanic transport airplanes. No flight controls, no weather systems, no navigating techniques, had ever been worked out for such operations.

In spite of the rigid specifications, a number of leading American airplane manufacturers submitted designs in response to Pan American's invitation. After much consideration, contracts were awarded to Martin and Sikorsky for the four-engined Clippers. The splendid flying qualities and performances of these ships considered against the period in which they were conceived, designed and built, is a triumph of which the entire American aeronautical industry may well be proud.

Almost every important division of the aeronautical sciences contributed invaluable research assistance to the designers. Manufacturers of engines and propellers, instruments, accessories and materials undertook special advancements of their products to make these ships possible. A whole history of the spectacular contemporary advance of American aeronautics could be written from an analyses of their details.

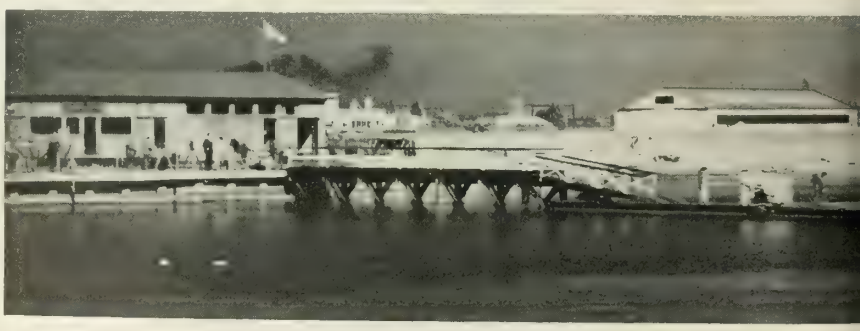
Once confident the ships would be forthcoming, Pan American set out to prepare its manpower and its technique. Fortunately it had at hand an ideal training ground laboratory for such purposes in the form of its network of over-water airlines in the Caribbean area and along the eastern coast of South America. Specifically the 600-mile open water stretch between Kingston, Jamaica and Barranquilla, Columbia became of great importance. Here the first crews larger than Pan Americans former three-man standard were worked together in the Sikorsky S40 Clippers and the Consolidated Commodores. Here were tested navigation systems, radio direction finders, emergency gear.

Two years before the beginning of operations in the Pacific the concept of an ideal crew for ocean flying was drawn up. Since it required a completeness and versatility of training never before approached, the whole basic organization of Pan American flying personnel was changed to achieve it.

Once the new Clippers became available, men, radio, technique, plans, all were put through long dress rehearsals in the Caribbean and out over the Atlantic east of Florida.

So much for the highlights and the background—the dimensions of the actual operations can be graphically illustrated by a few figures. The period of actual flight operations in the Pacific breaks into two portions of approximately a year each. The first extends from April 1935 through April 1936. In spite of all the elaborate preparations it cannot be fairly considered except as one of sheer pioneering. During it were carried out the four trailblazing flights of the Sikorsky-type *Pan American Clipper*, then late in November, the inaugural flight with mail, by the *China Clipper*, followed by a round-trip over the route as far as Manila by the *Philippine Clipper*. No schedule had been set, either by the Post Office or the airline, for the initial period of air mail operations. It is fortunate that this was the case; for a number of weeks following the *Philippine Clipper's* return, one delay after another prevented the resumption of flights. The *China Clipper* struck an obstacle in the water taxying out of the Alameda base. The *Philippine Clipper* was started through an engine change upon the assumption that the *Hawaii Clipper* would arrive within a day or two from the East coast. But ice in Chesapeake Bay prevented the *Hawaii Clipper's* departure westward. Two flights from San Francisco were forced to turn back due to excessively high headwinds encountered along the Great Circle Course. Completed crossings resumed in February, and two flights were made in March, two in April.

With the delivery of the *Hawaii Clipper* early in May 1936, operations moved rapidly toward a scheduled basis. Three round trips were completed in May; four in June; four in July. July 29 with the approval of the Post Office Department, schedules were announced for fixed departures from Alameda for every Wednesday afternoon at 3 pm. Departures from Manila on the return trip were fixed for each Friday. The record during the second year is really remarkable. May 18, 1936, the Clipper departure from Alameda was designated Flight 18—that is, the eighteenth *one-way* crossing of the route since the inaugural flight late in November. The ship awaiting the signal for departure May 19, 1937, was about to embark on Flight 111—that is, during the twelve month period no less than 78 one-way passages



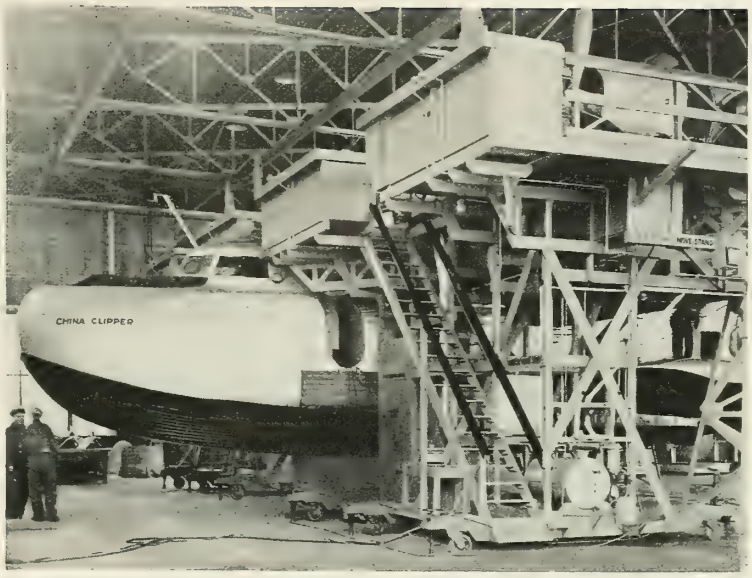
were effected over the San Francisco-Manila airway. During the entire year only six scheduled departures were cancelled—an operating record for the first year of scheduled transoceanic flying of 93%.

There are a number of corrolaries that can be made from this general statement that transoceanic operations as carried out in the Pacific are from the operations point of view, substantially successful.

1—The weather forecasting service, based by the airline's meteorologists upon reports from the Airways' bases, from innumerable ground stations in Asia as well as North America, and from ships at sea, has been satisfactory. Two items in this regard are deserving of comment—the cooperation received from the Matson Steamship Co. (operating steamers along the route from California to Honolulu), which consists not only of special observations of weather and cloud conditions from steamer-deck, but also, of data on upper-level wind direction and velocities from pilot balloon soundings; and the proven marked effectiveness of the Polar Front method of weather map analysis over so huge an ocean area as the North Pacific.

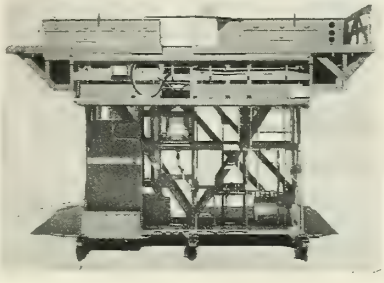
2—Methods used for navigation have also proved adequate. Basic is the use of celestial sights on sun and stars with the Pioneer bubble octant. Of no less importance is a thorough and continuous process of dead reckoning carried out through drift sights on specially designed aluminum bombs by day and on magnesium flares by night. Backing these two navigation methods and increasing swiftly in importance, as the Clippers approach their objective stations, are the long-range Pan American-type direction finders or DFs located at such points. Accurate within 1° up to ranges of at least 1800 miles, this equipment has proven to be free from almost every fault which besets other radio navigational aids with the exception of sunset and sunrise effects, and even these are not severe. As a fourth means of determining position, each Clipper carries a direction finder similar to those maintained at each shore station. With this device, cross bearings of great general utility are taken on ships and on shore stations.

3—Satisfactory navigation and weather techniques, coupled with a thorough and scientific method of cruising control (in turn based upon continual and unceasing performance records) have resulted in the utmost confidence by all concerned in the ship's ability to follow any predetermined route from terminal to terminal.




Acme Photo

*Portable work stands constructed especially for Martin flying boats*



"Predetermined routes," moreover, are not limited solely to Great Circle Courses. From the outset of the second year, the Clippers began making full use of a technique once assumed as a unique ability of lighter than aircraft—the circumnavigation of pressure areas to take advantage of tailwinds; marked deviations from the Great Circle sometimes as much as 200 or 300 miles. Before each departure a conference between the crew, engineering personnel and the meteorologists prepares a flight plan—path, altitude, engine speed and adjustments. Each leg of the transpacific crossing is broken up into zones, five, for example, between California and Hawaii. For each of these zones the conference makes a forecast of cruising time. Fuel loads are then based on total forecast time plus six hours (a 30% or greater reserve). And it is a true reserve—average accuracy of the forecast of crossing times is under 15 minutes; maximum deviations are well within an hour.

4—Even more basically "proven" than the operating technique, are the organization and preparation of the flight crews. As constituted in the Pacific Division, Clippers are manned by six officers: Captain, First Officer, Flight Engineer, Radio Officer, Navigator and Junior Flight Officer. The Engineer and Radio Officers are specialists in their fields. But each of the others are fully qualified to operate the plane, its engine and its radio and to take full charge of its navigation. As a consequence a definite watch system of duties and relief permits each man to spend 20% of his time resting or sleeping in one of the bunks provided for the crew.

Backing this crew set-up is a unique system of ranking and training. Obviously with such a diversity of tasks the old pilot co-pilot relationship ceases to have much significance. Instead Pan American set up four grades—Apprentice Pilot, Junior Pilot, Senior Pilot and Master of Ocean Flyingboats. Each has rigid minimum requirements of experience, flying time and demonstrated practical ability. But in addition an entire curriculum of subjects is laid out for each grade and proof of mastery of each through written examinations

(*Continued on page* 89)



# Aircraft Engineering Research Conference

## Summary of proceedings of the Twelfth Annual Conference of the National Advisory Committee for Aeronautics

**DR. MICHAEL WATTER**

● In keeping with its established custom, the National Advisory Committee for Aeronautics for the twelfth time assumed the part of host to representatives of the aircraft industry and government air organizations. On Tuesday, May 18, 1937 the Committee received its guests at the Langley Field laboratories and the busy schedule which started at 7:55 am and ended at 5:05 pm, saw innumerable demonstrations and conferences conducted with clock-like precision.

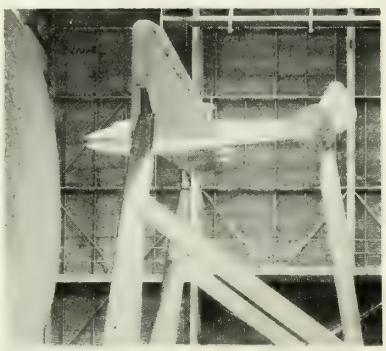
Opening session at the Post Theater of Langley Field was devoted to a brief welcome and a review of the status and findings of the Committee's research in its numerous phases covering flight, experimental and theoretical aerodynamics, cowling and cooling, engines and fuels, vibration and flutter, towing basin research and aircraft design.

After the opening session the six groups into which the attending members were divided were escorted through the High-Speed Tunnel, Gust Tunnel, Full-Scale Tunnel, NACA Tank, NACA Hangar, Atmospheric Wind Tunnel, Variable-Density Wind Tunnel, Power Plant Laboratory and Propeller Research Tunnel. At each of these units demonstrations were given of the outstanding research problem of the current year, of activities and a further review of the work of the particular branches of the organization. After luncheon, the guests and specialists of the National Advisory Committee formed six research conferences for the purpose of exchanging views, commenting upon the Committee's work and discussing the problems of interest to the industry. These conferences and the subjects discussed were as follows:

*Airplane Performance and Design Characteristics:* Lateral control: (a) wing stalling: (b) narrow chord ailerons and tabs; flaps for landing and take-off; stability; spinning; take-off; flying qualities; wheel shimmy; gust measurements; means for reducing vertical motion due to gusts.

*Aerodynamic Efficiency and Interference:* Drag of rivets and effects of surface roughness; compressibility effects; propeller performance characteristics; slipstream effects on wing and tail characteristics; wing fuselage interference.

*Cowling and Cooling Research:* Flight research on nose-slot cowling; aerodynamic efficiency of baffle system of an air-cooled engine; cylinder temperature correction factors for flight conditions; design of fins for air-cooled engines; compressibility effects on cowling; cowling of in-line air-cooled engine.



*Model of a 4-engined transport set up in the full scale wind tunnel; below it is a group of engineers and aircraft company officials attending the conference*

*Aircraft Engine Research:* A proposed method for rating fuels; altitude investigation of compression-ignition engines; friction of single cylinder and multi-cylinder engines; performance of two-stroke-cycle compression-ignition engine; performance of two-stroke-cycle spark-ignition engine; combustion characteristics of diesel fuel; pressures within fuel tanks during diving; rates of fuel injection; mixture-ratio indicators; method to indicate start of detonation; motion pictures of airflow in engine cylinders.

*Seaplanes:* NACA trim indicator; location and angle of stub wings; effect of certain modifications of a hull; flow patterns of water over hull; NACA Model 73 pointed step hull; effect of chine flare; comparison of results of different models in NACA tank-scale effect.

*Rotorplanes:* Effect of rotor-blade tabs on twist, blade motion, control force, lift-drag ratio; theoretical studies of rotor; preliminary results of effect of blade section on lift-drag ratio; comparison of drag of rotors for two types of control.

### Current Research

The extensive and varied data presented at the conference will permit only a brief commentary upon the highlights of the most pertinent problems. However brief this description may be, the profound importance of the Committee's work will be evident because of its broad scope and timeliness.

### Flight Research

To form a reasonable criteria of applied loads, the NACA has developed a V-G recorder—an automatic accelerometer which gives continuous record of accelerations of the airplane *vs* speed. This device is



particularly valuable for accumulation of authentic information on the effect of atmospheric gusts on the loads imposed upon air transports during normal operations. There are installed at present some 160 of these instruments in various airplanes and seaplanes operating in different sections of the world.

Statistical studies of the records obtained, parallelled with further studies of atmospheric gusts will aid both design and operation problems. This problem is being further investigated by a new gust tunnel—one of the many ingenious research devices which were shown this year. The value of this method consists in the ability to obtain the history of all factors involved under artifically controlled conditions.

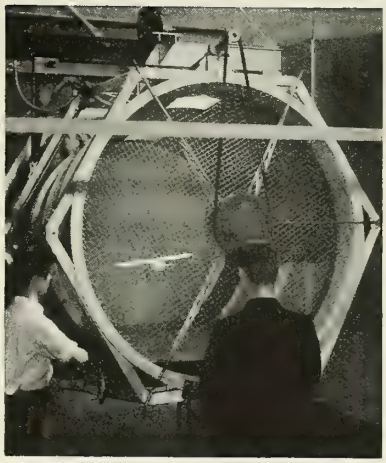
A model mounted on a suitable track is launched by a catapult and is thus guided to fly over an air jet-gust of controlled dimension and intensity. The models are equipped with miniature V-G recorders and are provided with lights not only to indicate the beginning of the operation of the recorder but also to provide a synchronized record of the airspeed, flight path and attitude of the airplane during the experiment. The Committee's Flight Laboratory continues its study of the experimental determination of stability control and performance as well as flight testing of the new NACA developments such as, for instance, sealed gap small chord ailerons and double-slot nose cowling.

#### Engine, Cowling and Cooling Research

Further investigation of the problems of suitable cylinder fin design indicates that machining difficulties of closely-spaced fins may be overcome by enlarging fin width from .62″ to 1.25″ with marked decrease in cooling losses. Experiments with modern diesel- and carburetor-type engines seems to indicate that their altitude performance is about equal with no indication of any weight superiority for either type.

This year's research on baffles adds another step in the successful fight against cooling losses. A new type of ducted baffle shown, decreases considerably the exit losses inherent to the commonly-used pressure type baffle. This gain is quite natural if one realizes that this is one more step toward elimination of eddying losses present at the rear of the cylinder. The successful fight with the turbulence losses due to pressure baffling led the NACA to further improvements of the nose-slot cowl which was first demonstrated at Langley Field last year.

Having done considerable research on pressure distribution over the contour of the engine cowl for different conditions of operation the committee has evolved and demonstrated at this conference a new type of controllable double-slot nose cowl. Since the location of the slot suitable for high speed operation is different



*New free-flight wind tunnel*

from that required for low speed the new cowl is arranged to permit opening of a suitable slot (or combination of both) depending upon the regime of flight. It is hoped that this cowl may prove satisfactory for the arduous conditions of engine operation which present design and operating requirements subject our power plants.

#### Seaplanes

The Committee's Towing Basin continues its experimental work on hull forms and effect of numerous variables which affect water performance of hulls and floats. The experimental studies are paralleled with theoretical investigations and certain novel forms and trends disclosed at the conference give a firm basis to the already rapid advancement of large flying boats. The immediate future will see the basin extended to some 2880 ft. which will expedite considerably experimental work in hull and float design. Recent researches show that a properly-designed and carefully finished hull of optimum dimensions may lead to improvements in performance which could not have been anticipated a few years ago. Research was further broadened to obtain in actual flight the theoretically best take-off behavior. This is made possible by the NACA trim indicator—a periscopic device enabling the pilot to see the angle made by the hull in relation to the horizon, and thus obtain the best attitude of the hull during take-off. Important studies of scale effect, model test comparisons and sea-wing research were major topics among many other subjects discussed.

#### Structure

In addition to experimental and analytical studies of gusts and applied loads, a number of other researches are being conducted. Column behavior in reinforced flat-skin constructions, lag in stress distribution of box beams are but a few of the problems now being investigated. In connection with column behavior, it is significant that comparative column stiffness of a true column such as a member of fuselage truss, cannot be compared without a number of correcting effects to a stringer of a wing box type beam where compression is strictly due to bending, is not present without it and is always in combination with it.

#### Propellers

The Propeller Research Tunnel is again embarking on a comprehensive series of investigations, the program being intended to extend the tests previously made and to anticipate the growing demands of the industry. The scheduled research will include the effect of 6 airfoil sections; tip speeds from 200 to 1000 ft./sec.; 2-, 3-, and 4-bladed propellers; 6 different blade shapes; thrust determination for various flight and propeller regimes; blade deflection; and effects of body shapes. Importance of this research cannot be overemphasized and some of the results have brought to light factors the materialness of which has only lately become apparent. The compressibility effect at high angles of blade action has been established beyond doubt thus correlating propeller research and compressibility effects brought out in the comparatively recent past.

#### Experimental and Theoretical Aerodynamics

Work of the Variable Density Tunnel which has contributed, among other things, so largely to our knowledge of airfoil selection and has been responsible for the best sections used at present, continues along these lines but with improved and added equipment. In the attempt to obtain an airfoil possessing low drag for high speed and gradual stall for safety in landing, a new type of stall control flap was demonstrated. The normally-present abrupt drop in the lift curve by the use of this device is transformed into a gradual rounded top type of lift curve without loss in the maximum lift obtainable.

The High Speed Research Tunnel is engaged in further research on the aerodynamic effect of rivets, seams and other irregularities confirming the economic penalty associated with the high speeds expected of the modern airplane. This penalty consists in great power losses due to irregularities in contour and finish; from a different point of view, this penalty may be regarded as added to the cost of manufacture of the airplanes, were they to be built with the degree of care demanded by maximum performance.

Research of compressibility effect is being extended to include body shapes and nacelles and it is indicated that comparatively slight improvement in the rate of change of curvature of the forward parts of a streamlined body bring marked increase in the critical speed at which the

(*Continued on page* 90)

# EDITORIALS

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**"The engineers in aviation have given us reliable motors and aircraft; aeronautical engineering is farther advanced than pilot technique and medical research. The engineering art has given us these mechanical things that have brought us so far, but it cannot put brains in the airplane. The brains are in the heads of the pilots flying the airplanes, and we are trying to better equip these pilots with knowledge and training so they can perform instinctively as they should, under stress conditions."** — ***Major R. W. Schroeder.***

## Misleading Army Statistics

In the $416,413,382 War Department appropriations bill passed by the House of Representatives was $67,075,514 for the Army Air Corps and funds for the purchase of 513 new airplanes.

This last item is definitely misleading. To the public, an Army airplane is a fighting airplane, and the man in the street was hoodwinked, perhaps unintentionally, when he scanned the UP news release of May 1 on the Army appropriations bill and read that "a total of 902 airplanes now are in service, or will be by June 30."

At this moment the GHQ Air Force has on hand only 288 modern combat airplanes for the defense of continental United States; there are 89 bombardment, 87 attack, and 112 pursuit. The figure "902" is arrived at by including training planes, transports, Army Corps observation types, and aircraft assigned to such distant places as the Canal Zone, Hawaii, and the Philippines; none of these latter craft are immediately fit for combat service and some never will be.

Even more misleading is the statement in the same news release that "during the 1938 fiscal year, the Army expects to receive, from 1938 and previous fiscal year purchases, 715 additional planes, making a total of 1617". During the 1938 fiscal year, the Army actually will receive *no additional airplanes from 1938 fiscal year purchases,* and by no means *all* of the 544 planes on current 1938 and previous procurement contracts, because it takes nearly two years for 100% delivery on a contract.

Therefore, the best that can be expected is 100% delivery on 554 planes by 1939, instead of 715 additional aircraft "expected to be received in 1938".

At that, the net gain by 1939 will be considerably reduced by losses through obsolescence and other causes.

Summing it all up, we find that right now the defense of 3,026,789 square miles of territory is left to the care of 288 airplanes or one to each 10,509 square miles of territory and 429,810 persons in the United States. Quite a task for a single airplane—especially the single seat fighters.

Let's not fool ourselves or the public by relying on vague statistics which never can do the work of large numbers of real combat planes.

## New Radio Aid to Navigation

Some consideration has been given to the idea of using an electromagnetic cable on the ground to guide aircraft through some of the passes of the Rockies and the Sierras. It is in this region that the radio beam has, occasionally and at the most embarrassing times, engaged in some very peculiar and dangerous antics.

Engineers have shied away from this device because of the probably prohibitive cost involved in the initial work. Yet, aside from the cost factor, the plan seems feasible enough.

On the other hand, if three or four of the operators get together and considered the matter, it is conceivable that the cable could be laid on a share-the-cost basis. This will carry just one step further the fine spirit of cooperation now in vogue among the operators in the efforts to further airline safety.

Paced by a more sympathetic Bureau of Air Commerce, operators undoubtedly would find in the government another contributor to the cause.

## Modernization Of Air Commerce Bureau

As reorganized, the new set-up of the Bureau of Air Commerce has many distinct advantages over the old system, and if the seven subdivisions and their personnel are permitted to function as planned, something will be accomplished. The long-delayed modernization of the Government's 23,000 miles of airways, it is estimated, will call for the expenditure of $5,000,000.

Relegation of duties to individual divisions should result in an intelligent handling of the industry's problems. Specialization has always been conducive to better results through a clearer understanding of what should be done and how it should be accomplished with least friction and quickest action.

There still is much to be done before air lines in this country, or any country, can achieve the highest degree of safety. Aircraft radio for communications and navigation, instruments and other safety elements must be subjected to a thorough dissection in an effort to eliminate the remaining obstacles in the path of safe and dependable air transportation. This is a big order which makes the work of the Safety and Planning Section most important.

One thing that would hinder orderly progress in the Safety and Planning Section would be diversion of its appropriations to other divisions in the Bureau. No division in the revitalized Bureau is more important than the Safety Section which is charged with conducting the development and promotional work for the Bureau.

Every encouragement and no curtailment or disversement of funds should be permitted to interfere with its work.

## Lesson Of The "Hindenburg"

The most obvious and costly lesson drawn from the deplorable disaster to the German airship *Hindenburg* is the imperative necessity for discarding hydrogen as the buoyant agent. The dirigible was destroyed by a hydrogen fire although the reason for its origin may never be definitely determined.

With a virtual monopoly on helium, the United States might be criticized for withholding the gas from Germany, but this government never intended to make the use of helium impossible for the inflation of foreign passenger dirigibles.

The Senate Military Affairs Committee has approved a bill providing for the sale of the gas in non-military quantities. Approval of this bill would make it possible for Germany to continue her dirigible building program with a greater degree of success.




# POWERFUL "HEAVY DUTY" WRIGHT CYCLONES

## *Speed these Giant* TWA SKYSLEEPERS

Transcontinental & Western Air's new schedules, effective June 15, 1937, provide the fastest air passenger service across the United States . . . overnight from Los Angeles to New York in 14¾ hours . . . non-stop, St. Louis to New York in 4¾ hours.

A fleet of luxurious TWA "SKYSLEEPER" Planes, built by Douglas, will inaugurate this new transcontinental service. These Super-Skyliners will be equipped with "Heavy-Duty" G 100 Wright Cyclones — the most powerful aircraft engines in use on any airline in the world—with the highest U. S. Government A.T.C. horsepower rating!

The Douglas TWA "SKYSLEEPERS" have established a new standard of transcontinental travel by air. Each plane is licensed to carry 25 passengers and is equipped with large comfortable sleeping berths and deluxe divan chairs.

The "Heavy-Duty" G 100 Wright Cyclones, installed in the new TWA "SKYSLEEPER" Planes, are operated on 55% of available power at cruising speed—providing maximum cruising and operating efficiency plus a 45% power reserve.

*TWA has flown Cyclone-Powered Douglas airliners 25,000,000 miles.*

WRIGHT

AERONAUTICAL CORPORATION

# WINGS ★ WEST OF CHICAGO

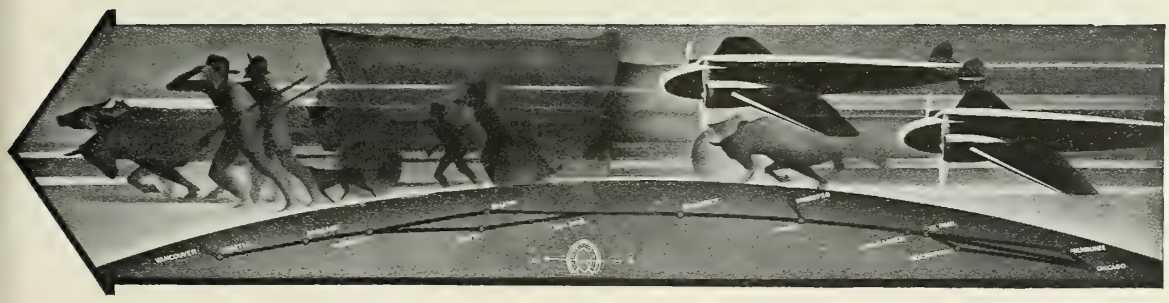




*"Texaco Asphalt makes resilient, rugged, economical surfaces for airport runways, Hangar floors and aprons, driveways, and parking areas."*

*From the Great Lakes to the Pacific, across the Rockies, the territory flown by Northwest Airlines puts unusually severe demands on engine oil. They are using Texaco.*

# TEXACO



*This mural in its St. Paul terminal contrasts the pioneer's trek westward with the precision flights of Northwest Airliners. Northwest, now in its 11th year, uses Texaco Airplane Oil exclusively.*



ONE hundred and forty-two years ago, Lewis and Clark required a year and a half to push through to the Pacific. Today, Northwest Airliners cover these 2000 miles in a little more than 12 hours.

While, technically, this is probably the toughest air route in all America, Northwest Airlines has made it pleasant to travel. Everything is done for comfort and safety . . . the finest equipment . . . in all engines, Texaco Airplane Oil.

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Using Texaco, you get longer periods of service between drains, more flying hours between overhauls.

Trained aviation engineers are available for consultation on the selection and application of Texaco Aviation Products. Prompt deliveries assured through 2020 warehouse plants throughout the United States. The Texas Company, 135 East 42nd Street, New York City.

TEXACO

# Aviation Products

# AIRPLANES ~~CAN'T~~ SINK BATTLESHIPS

## With All Due Respect to "The Saturday Evening Post"

**CY CALDWELL**

● On April 10 the *Saturday Evening Post* featured an article called "Airplanes Can't Sink Battleships." Twenty days later, strangely enough, in a brief engagement five miles off the coast of Santander, Spain, airplanes sunk a battleship. The *Post* was founded by Ben Franklin, who once said, "*Experience keeps a very dear school, but fools will learn in no other.*"

The battleship which was sent to the bottom (by only two hits from two 210-pound bombs it was reported) was the Spanish rebel warship *Espana*. It sunk in 45 minutes. The day that word of the sinking was received here, our Navy Department's highly-efficient propaganda department informed the taxpayers that the *Espana* was obsolete. The Navy's definition of an obsolete battleship apparently is one that has been sunk by bombs dropped from an airplane; a modern battleship is one that has not yet been sunk. In the 1921 Army-Navy bombing tests the Navy had to admit that airplanes could sink stationary battleships, but declared that a battleship in action, steaming at full speed and wildly dodging bombs would tell a different story. The *Espana* was in action, firing her modern German anti-aircraft guns manned by trained German crews; the *Espana* now lies in 200 feet of salty water. It didn't dodge.


AIRPLANES CAN'T SINK BATTLESHIPS

By ENSIGN JACK LINCKE

The *Espana* was attacked by Russian airplanes flying for the Spanish government. One after another they dived almost straight down on the warship; one after another seven high explosive bombs hurtled downward. Five missed the ship, and may have exploded in the water; two crashes echoing shoreward told watchers five miles away that two bombs had hit the ship itself. Soon black columns of smoke emerged from the *Espana's* stern, which, within a half hour, was flush with the water; her bow rose high. A destroyer whose anti-aircraft guns had tried to aid her in her fight against the bombers came alongside to take off the crew. Men could be seen from shore, through glasses, rushing about the decks and jumping into the sea. In only 15 minutes more the *Espana* was gone with a roar of bursting boilers and a rush of escaping steam. 700 men are said to have perished.

Until divers have examined the sunken hull down in Davey Jones' locker and have made their report it is impossible to say with any certainty just how the battleship was sunk. The British Admiralty, nervous about the waning prestige of the British Navy after its retreat from the threat of Italian Air Forces in the Mediterranean during Mussolini's Ethiopian escape of wholesale murder, immediately set its own propaganda department to work to inform English taxpayers that the battleship had been sunk, not by bombs dropped from airplanes, but by a mine. It would be a miraculous coincidence that at the *exact moment* when bombs hit the ship's deck that a mine went off aft, against the hull! But anything is possible to a Navy propaganda department, hired to delude taxpayers into believing that Navies can protect their country. One of our own Admirals informed the press that the *Espana* was no more than an armored freighter and not to be considered in the same class with a modern (or unsunk) battleship. Let us see how far from the truth an admiral who wishes to delude taxpayers will venture.

In Jane's *Fighting Ships*, a reliable compendium of the world's naval forces, appears this description of the *Espana*. Formerly named the *Alfonso XII*, it was completed in 1915, is the same age as the American battleships U. S. S. *Pennsylvania* and *Arizona*, a year younger than the *Oklahoma* and *Nevada*, three years younger than the *New York* and *Texas*, four years younger than the *Arkansas* and *Wyoming*, and five years younger than the *Utah* and *Florida*. But it's obsolete, say our Navy people. If the *Espana* is obsolete, what is the condition of these American battleships, which are from one to five years more ancient than she was?

We hear a lot about the "modernization" of existing old battleships in our Navy, but so far as defense against attacking airplanes with their high explosive

(*Continued on following page*)

THE NEW YORK TIMES, SATURDAY, MAY 1, 1937

# REBEL BATTLESHIP IS SUNK BY SPAIN'S LOYALIST FLIERS; CRUISER ALSO PUT TO FLIGHT

### MEN LEAP INTO SEA

110 of Espana's Quota of 854 Known to Have Been Rescued

BRITISH CRAFT IS SAVED

Merchantman, Pursued Five Miles Off Santander, Slips Away During Fight

120 PLANES RUSH TO BILBAO

Basques Say 1,800 Germans Have Landed to Aid Franco —Irish Bare Rebel Blunder

**The Spanish Situation**

SANTANDER—The Rebel battleship Espana was sunk by bombs from five airplanes off Santander as she pursued a British blockade runner. The fate of her crew of possibly 854 is in doubt, but some were rescued by a destroyer. The cruiser Almirante Cervera also was attacked and put to flight. Page 1.

# Curtiss HAWK 75 PURSUIT AIRPLANE

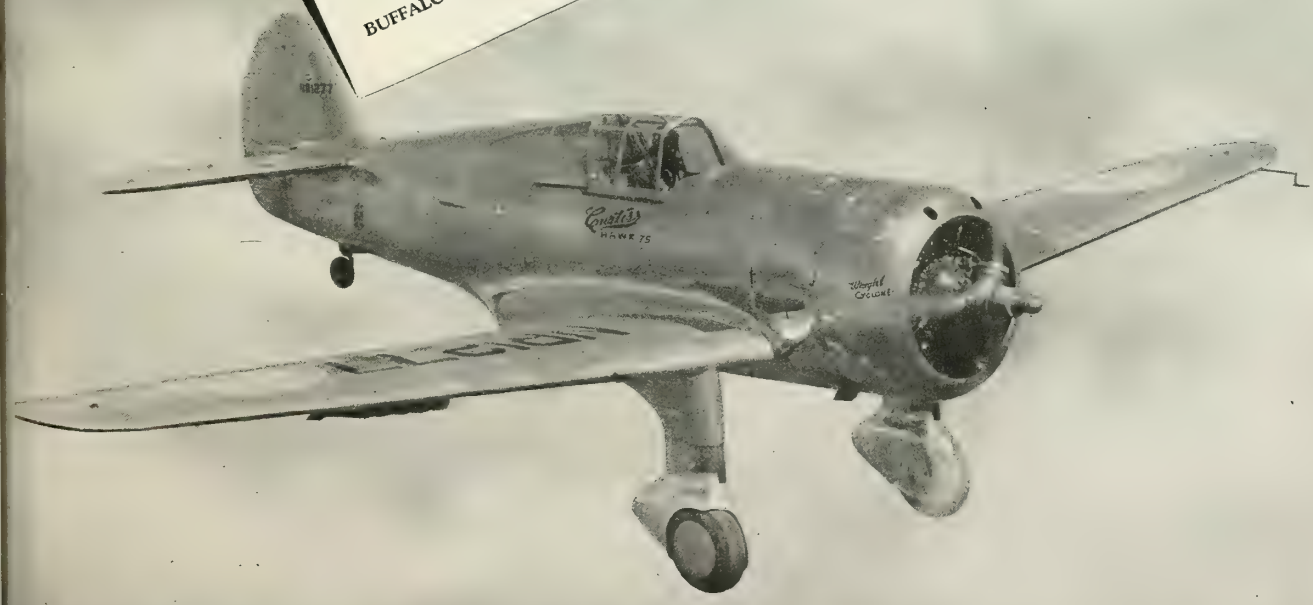



The new CURTISS HAWK 75 monoplane is a single-place pursuit airplane of all-metal construction—an adaptation of the Curtiss Y1P-36 Pursuit Airplanes recently delivered to the U. S. Army Air Corps.

★

Armed with four forward-firing guns, the new CURTISS HAWK 75 is one of the most formidable military weapons ever built. Equipped with a 1000 H.P. Wright Cyclone and a Curtiss Constant-Speed Feathering Propeller, it offers outstanding speed, climb and maneuverability.

CURTISS-WRIGHT CORPORATION
CURTISS AEROPLANE DIVISION
BUFFALO "The Pioneers of Aviation" NEW YORK




Curtiss PRECISION-BUILT ARMY AND NAVY AIRCRAFT

(*Continued from preceding page*)
bombs is concerned the only modernization possible is the addition of blisters (built-on side-plating with an air space between that and the former side of the ship), heavier deck armor, more anti-aircraft guns, changes in the structure of the masts, and in the fire-control system. The under-water hull of the ships, except for the sides, remains unchanged; so does the ship's interior. It's the same old target, with new trimmings, that's all.

#### Details of the "Espana"

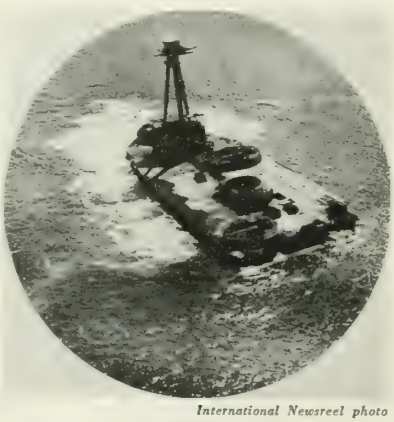
The *Espana* was a battleship of 15,452 tons displacement, carrying a crew of 850 officers and men. She was 435 feet long on the water line, had a beam of 78 feet ("width" to you landlubbers), and drew 25 feet of water. Her length over all was 459 feet. Thus to the attacking bombers she offered a target of about 35,000 square feet. How could they miss if they had skill and determination? Our own Army bombers have hit moving targets at sea from 10,000 feet—and the Russians are said to have dived nearly to the deck of the warship before "laying their eggs." The *Espana* was a pushover and now undoubtedly is "obsolete." As to the *Pennsylvania, Arizona, Oklahoma, Nevada,* and —well, write your own answer.

The *Espana* was protected along the sides by an 8-inch belt of the finest Krupp armor amidships, by a 3-inch belt at the bow, and a 4-inch belt aft. She had a 1½-inch armored deck of Krupp steel—admittedly not enough protection against heavy bombs, though 210-pounders are not considered heavy. In offensive qualities she was rather a powerful "freighter," under that belittling propaganda admiral's definition. She carried eight 12-inch guns, twenty 4-inch, and numerous anti-aircraft guns of the latest German type, in addition to machine guns. Yet with all her collection of guns she could not register *one hit on one of the airplanes that attacked her,* although she was assisted in her last fight by a destroyer, whose anti-aircraft guns also helped fill the sky with shells, exploding willy-nilly, hither and thither, and hitting precisely nothing. And that was the famous "barrage" we have been hearing about, the storm of shells that were to knock attacking airplanes out of the sky! They might as well have thrown jelly beans; the effect on the airplanes would have been identical. Our own Navy has shot down hundreds of airplanes—in the newspapers—but a battleship in action unfortunately is being defended by Naval gunners, not by the Navy's propaganda department.

The *Espana* was powered by Parsons turbine engines of 15,500 hp turning 4 screws, and able to drive her at a speed of 19½ knots. Her bunkers could carry 1900 tons of coal and 20 tons of fuel oil, and the normal radius of action was 5000 miles at 10 knots, or 3100 miles at 16 knots. Quite a powerful "freighter."

For protection against the effects of under-water explosions—such as the five bombs that were said to have dropped alongside of it—the *Espana* was divided into 17 watertight compartments on each side, or 34 compartments in all. The *Utah* and *Florida* have only 4 more, as they are larger warships; the *New York* and *Texas* have only 8 more compartments. However, the internal bulkheads of these older American battleships are of high tensile steel 1½ inches thick, while that of the *Espana* was much lighter. There is no doubt that the *Espana* was considerably inferior to even the older of these American battleships, and I am not trying to make the point that what happened to her would happen as easily to an American ship of like vintage; what I wish to stress is that the *Espana,* obsolete though she was as a battleship, *still carried more protection against aerial bombs than any of our warships except the battleships themselves.*

Our light cruisers of the *Omaha, Milwaukee, Trenton, Marblehead, Detroit, Memphis, Richmond,* and other classes have only 1½ inch deck armor, like the *Espana,* and only 3-inch side armor. These all could be damaged as easily as the *Espana;* for nowhere have they more protection, and in many places they have less.



*International Newsreel photo*

***By way of coincidence, here is the first "Espana" on the rocks fourteen years ago***

Our most modern light cruisers (the ones being built now), also have 1½ inch deck armor and slightly more in some ships, and heavier armor over vital parts such as the engines and boilers. But none of it is sufficient to withstand the explosion of 1000-pound bombs or even 500-pound bombs. As for the 4000-pound bombs that could be dropped from land-based bombers, such as the new 4-engined Boeing, that bomb would blow a light cruiser right out of the water, and in small pieces.

Protection of destroyers, submarines, and supply ships against bombs simply does not exist. Any and all of these craft could be put down with bombs weighing as little as 500 pounds. Nobody can say definitely how many of such medium-sized bombs are required to sink these unarmored ships; in some instances one bomb might do it, in other instances two or three might turn the trick. It all depends on where the bomb explodes, on or near what vital part of the ship it hits. As to the 1000-, 2000-pound, and larger bombs one direct hit or one close alongside, and that ship is going to the bottom in a hurry.

#### On or Alongside

It is possible that the bombs that hit on or alongside the *Espana* were assisted in their destruction by a minor ammunition explosion on the battleship itself, which blew part of the bottom out of the ship, for it seems impossible that such small bombs could have sent the ship so quickly to the bottom. Then, too, the bombs may have been much heavier than 210 pounds, or more than two may have hit. Our own Air Force would not consider dropping bombs so small on a battleship and expect them to do any permanent damage. However, it is not necessary for us to speculate about the exact details; the important point is that a *battleship has been sunk in action by airplanes.* And if airplanes can sink the much-vaunted battleship, every other type of warship in the fleet is duck soup! And without their protective screens of cruisers, destroyers, and submarines, the few battleships we have—only 15—are incapable of carrying out the duties of a fleet. They may as well be left floating in the middle of an ocean, until airplanes sink them. And the same goes for enemy battleships that try to attack us. Against shore-based heavy bombers all warships, including aircraft carriers, are helpless targets. Even in the middle of the ocean they are not safe from bomb attacks from shore.

The lesson we should learn from the *Espana* sinking is that Sea Power is passing, that Air Power is coming into its own, and that (as pointed out in my article of last January) Air Power in the future will exert as great an influence upon the course of history as Sea Power has exerted in the past.

It is sound judgement, of course, to keep our present Navy, for as yet we have so few airplanes—really no more than the beginnings of real Air Power in the United States. The Army GHQ Air Force has only about 260 combat airplanes, few of them of the type that will represent Air Power—and that type is the heavy multi-engined bomber. We have only three or four of them, with 13 all told on the way. Until we have built up our land-based Air Force, our Navy, headed for oblivion though it undoubtedly is, still is necessary.

The *Espana* incident is merely the prelude to that drama of the sea and the air that will be played in our lifetime,—the Passing of Sea Power.

# THE *Plus* OF WACO OWNERSHIP...



● The Waco owner forfeits none of the advantages that attend ownership of the finest automobile. Waco seats are luxuriously comfortable, and cabins are generously spacious—licensed for five persons . . . Waco performance satisfies the most critical demands . . . And Waco offers the benefits of world-wide sales and service facilities approached by no other airplane manufacturer. Your local dealer will welcome an opportunity to demonstrate.

*Waco Leads in Aircraft Registration*

WACO AIRPLANES

THE WACO AIRCRAFT COMPANY
TROY • OHIO

# Development and Production of a Solid Steel Propeller

*DR. ALEXANDER KLEMIN*

● Development of the solid steel propeller was attended by numerous difficulties for when steel was substituted for wood, weight increased with no counter-vailing aerodynamic advantages. Reduction of blade width and thickness resulted in too narrow a planform and undersirably large diameters, and sheet steel propellers were unsatisfactory in service as they did not provide sufficient strength in either torsion or bending.

The hollow steel propeller, in which the material is correctly disposed at a distance from the centroid of the blade element, has proved more satisfactory from the weight point of view, but has presented other difficulties. When the metal is satisfactorily disposed away from the centroid the section becomes thicker than is aerodynamically necessary, and with the present high tip speed ratios, a high thickness ratio becomes even more objectionable because of the "compressibility burble" occurring at (or near) the speed of sound.

Construction and maintenance difficulties also are present in the hollow steel propeller. In welding, distortion and warping in the blade surface cannot always be eliminated; also the weld along the edges is subject to fatigue stresses, due to a "breathing action" of the plates caused by centrifugal forces. Grinding operations lead to uncertainty as to the thickness of material left under the weld and heat treatment of a hollow steel blade of varying thickness presents further difficulties.

While the hollow steel propeller undoubtedly has adequate strength without excessive weight, it is perhaps too rigid to absorb heavy and periodic engine impulses without concentration of high stresses at the hub end of the blade. Fabrication by welding is an expensive procedure and another difficulty is that the hollow steel propeller is not readily repairable when dented or bent, and offers no method of inspection inside the blades.



*12-foot solid steel propeller with Curtiss controllable hub, on U. S. Army test rig at Wright Field, Dayton, Ohio.*

*Below—parts comprising 3-way hub and (right) blade root section showing grain flow following surface contours*

Recently progress has been made in overcoming the above difficulties, but, simultaneously, manufacturing cost has been increased.

### New Approach to Construction

Early attempts at steel propeller construction never attained practical solution, and the principles of the McCauley solid steel propeller are therefore interesting. While no new construction design is ever based on a systematic statement of past difficulties or ideal requirements, the designer of the McCauley propeller probably postulated his problem thus:

1—Engine powers and airplane speeds are constantly increasing and propeller blade thickness cannot increase on aerodynamic grounds; therefore a material of high intrinsic strength and high fatigue limit (namely, heated treated steel alloy) must eventually be utilized.

2.—Hollow steel blades lead to difficulties in construction and maintenance, and a method must be found to produce a solid blade that is not only easy to manufacture and uniform in manufacture but also of greater strength, as an important element in safety.

3—For efficiency, the blade must be thin and of moderate weight, yet have its material so disposed as to not only provide adequate flexural strength, but also adequate stability in torsion.

4—The airfoil section must be aerodynamically efficient, and of a form which will provide stability in torsion.

5—Blades must be sufficiently flexible to take up engine impulses, and to secure relief of bending by centrifugal moments, yet be immune to flutter or vibration.

These considerations resulted in a new approach to the construction of steel pro-

(*Continued on page* 35)





# TRUSTWORTHY ELECTRICAL EQUIPMENT



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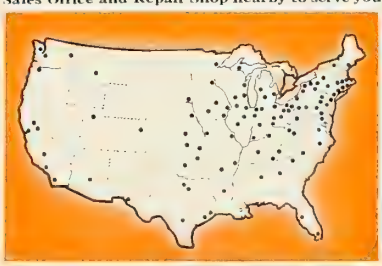
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# P-35
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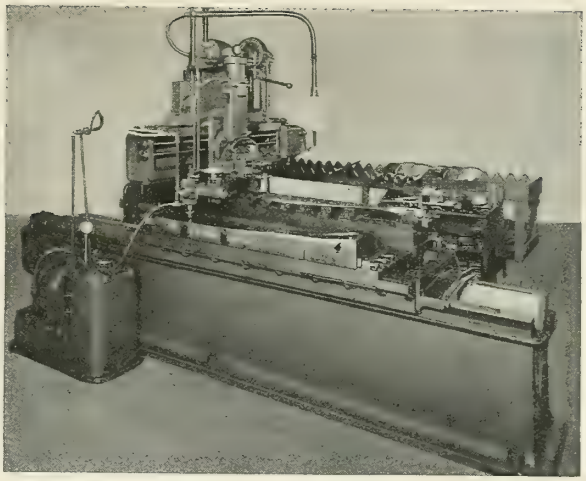
FARMINGDALE, LONG ISLAND N.Y.

BUILDERS OF THE WORLD'S FASTEST AIRPLANES

(*Continued from page* 32)
pellers, which, in the light of subsequent knowledge appears logical.

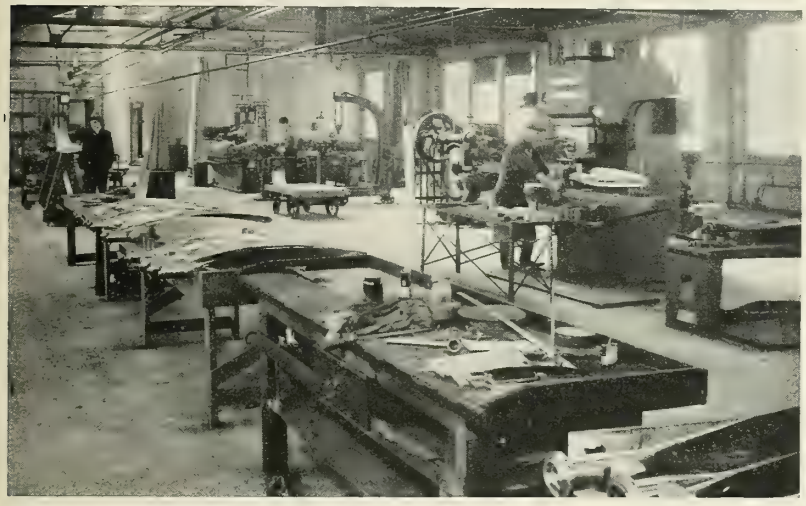
### Special Airfoil

The McCauley airfoil is a thin, medium cambered section, with a rounded symmetrical leading portion, smooth concavity of the under surface and slight degree of reverse trailing edge. Wind tunnel tests at Langley Field, New York University, and University of Michigan, have shown this airfoil to possess low minimum drag and high maximum $L/D$; lift slope equal to that of conventional blade elements; and practically constant position of c.p. In addition to these aerodynamic characteristics, appropriate properties have been secured in material distribution with the use of this airfoil.

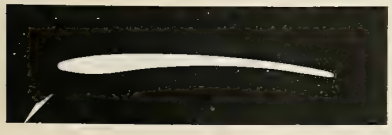


*Propeller blade forgings machined in special Rockford planer-duplicator.*

*Below: a corner of blade department*



Use of the conventional propeller airfoil when building in steel, produces either an excessively heavy blade, or else one too flexible in bending and torsion. In the McCauley airfoil, the material is spread further away from the center of gravity in arching or cambering when the blade is forged. Furthermore, adequate bending and torsion strengths are obtained with a thin section, 50% of the weight in cross section being concentrated in the forward 33.33% portion of the airfoil. With a conventional propeller blade the center of gravity of the section is located at about 40% to 44% of the chord; with the McCauley airfoil, the c.g. is at about 35%. It is known that for a given length of fuselage and horizontal tail area, the airplane that has its c.g. furthest ahead of the chord has the greatest longitudinal stability. Similarly, in a propeller, the further forward the c.g. of the blade elements (and to some extent, the less the c.p. travel) the less likelihood of oscillation in torsion. The profile of the blade therefore has an important bearing on the anti-vibration and anti-flutter properties of the solid steel propeller.



*Profile of the McCauley blade*

### Aerodynamic Efficiency

Embodied in steel, the McCauley airfoil permits a thinner section to be employed from which it derives the possibility of delaying compressibility effects and of avoiding unduly thick and inefficient sections near the hub.

The airfoil is only one element in propeller efficiency—planform, blade angles, etc., must also be considered. But the solid steel propeller can embody all other efficiency-producing factors just as readily as any other type of propeller.

While no extensive comparative data of aluminum alloy and solid steel blades are available, data at hand are encouraging. The accompanying table shows results of Wright Field tests on a 300 hp (at 2,000 r.p.m.) Stearman BT-S.

| Propeller | Setting at 42" radius | High speed (rpm) | High speed (mph) | Rate of climb (ft./min.) | Take-off (sec.) |
|---|---|---|---|---|---|
| Solid steel | 14° | 2150 | 140.5 | 1100 | 12.7 |
| Alum. alloy | 16° | 2150 | 139.0 | 1015 | 14.5 |

Many variables enter into propeller efficiency and no such test can definitely establish superiority of one type over another, but there is an indication of equal or greater efficiency.

### Considerations of Weight

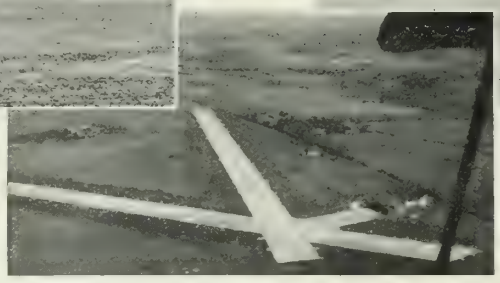
The following table is a comparison of weights for 300 hp, 9 ft., two-bladed propellers of the same planform.

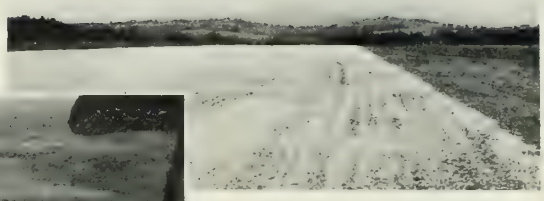
| Propeller | Specific weight (lbs./cu. in.) | Weight per blade (lbs.) | Weight of hub (lbs.) | Total weight (lbs.) |
|---|---|---|---|---|
| Solid steel | .283 | 29.5 | 23.5 | 82.5 |
| Hollow steel | .283 | 27. | 30 | 84 |
| Alum. alloy | .101 | 24.5 | 31.5 | 80.5 |

Weight differences between the solid steel propeller and the aluminum alloy propeller are so small that these would be more than compensated for by the gain in efficiency due to the thinner sections it is possible to employ. While the conventional aluminum alloy propeller holds an advantage in being lighter, steel has an ultimate strength of 150,000-175,000 lbs., as compared with 50,000 to 60,000 lbs. for the aluminum alloy and the "centrifugal relief" obtained in the transition from wood to aluminum alloy is even greater when solid steel is employed. Typical blade shank dimensions are: 3" o.d., 2.25" bore for the solid steel and 3.7/8" of solid root diameter for the aluminum alloy blade. A smaller shank diameter and the shorter hub length with a steel blade gives a lighter hub, making the total weight of the solid steel propeller approximately equal to that of the aluminum alloy propeller. (*Continued on page* 93)



*Barre-Montpelier Airport, a principal stop along the National Airways route*





*Granite chips sharply defined against the green background of surroundings*

# DEVELOPMENT OF AN INTER-CITY AIRPORT

***City Engineers T. W. DIX (Barre) and G. A. REED (Montpelier)***

● In the construction of the Barre-Montpelier Airport in Vermont there were a number of problems, a brief resume of which may be of interest to airport engineers in other cities.

Usually a public works construction is confined to a single administrative unit and within the corporate limits of a single municipality. In this instance, however, the airport is not only outside the corporate limits of either city, but is located within an entirely different township. Under a Vermont law, passed March 19, 1935, cities within the state are authorized to meet such a situation by mutually determining upon a commission to handle the work. A commission was appointed, under date of November 25, 1935, made up of representatives from the two cities, and with arrangements whereby the two city engineering departments would cooperate in developing suitable design and construction procedure.

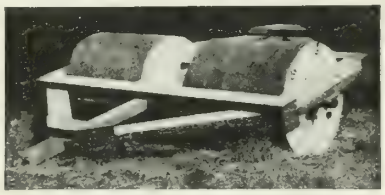
Preliminary detail was accomplished with minimum delay, and actual work upon the airport was begun March 5, 1936, with substantial progress dating from May 1 of that year. The site was selected for its accessibility to both cities, and is unique in that it is located on top of a plateau in such a way that there is no interference from adjacent buildings or structures.

The airport was constructed as a WPA project, the cities of Montpelier and Barre each appropriating $16,000, and the government furnishing $13,000, together with the labor. Some of the unit costs follow:

| | |
|---|---|
| Grading ..... | $0.60 per cubic yd. |
| Gravel base ..... | 0.80 per sq. yd. |
| Primer ..... | 0.047 per sq. yd. |
| Penetration macadam surface course ..... | 0.235 per sq.. yd. |

The above figures are exclusive of common labor, and the cost of the airport as completed totals approximately $68,700.

Care was taken to obtain proper grading and drainage first, as this is fundamental to the construction of durable airport surfaces. It is more important to obtain perfect drainage and employ a low cost type of surfacing than it is to ignore drainage and build a high type surface because, in the long run, the latter will fail if it is not adequately protected.



*Concrete roller built for runways*

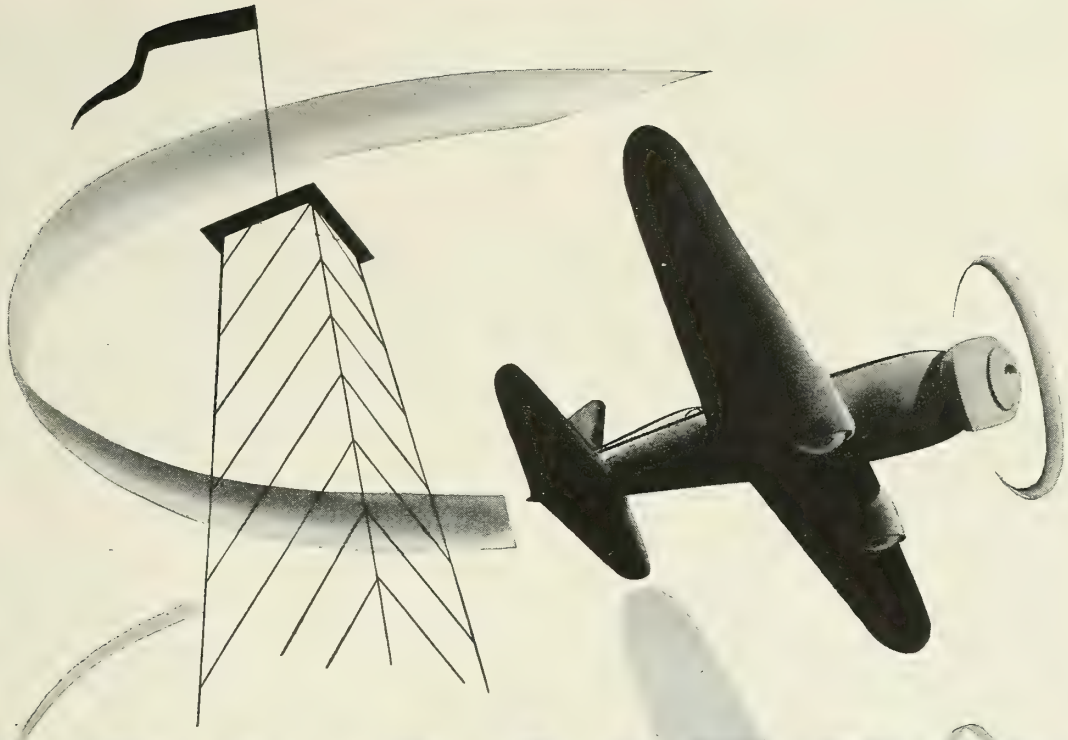
Vermont is well supplied with good construction materials and, as Barre is famous for the quality of its granites, it was natural that crushed granite should have been the material selected for the surfacing aggregate. The runways are each 2200 ft. long and 100 ft. wide, with tile drains installed at either side and backfilled so that surface water readily percolates to the tile to be carried away. The slope of the shoulders from the runway is gentle so that there is no abrupt change of profile in crossing from adjacent sections of the field across the runways themselves. The foundation is composed of bank run gravel spread to a compacted thickness of 8″, with an additional sub-base placed over some soft areas. Care was taken in the consolidation of this gravel so that no further settlement would occur after the wearing course had been constructed. The surface of the gravel was carefully primed and then the crushed granite spread to a loose depth of 2.5″ and rolled to a compacted depth of 2″.

Discussion was had as to the type of surface to be placed on these runways. In northern Vermont winter temperatures are low; in the summer the airport is exposed to the direct rays of the sun, so that while a highly ductile material was desirable it had to be one which would neither be brittle in winter nor too soft in summer. Taking these factors into consideration, it was finally decided to lay an asphalt penetration macadam surface except that the stone was of somewhat smaller size than the conventional coarse macadam, and was so thoroughly keyed prior to the application of the asphalt that the quantity needed for binder was somewhat reduced in amount as compared with usual procedure. The first application, which was applied by a pressure distributor, was made at the rate of 1.25 gal. per sq. yd., and then covered with 15 lbs. of ⅜″ to ¾″ stone per sq. yd. The surface was then thoroughly rolled.

The smooth profile and cross section may be attributed to the rolling method utilized. In spite of the care exercised during initial compaction there were slight longitudinal ridges. Finally it was decided to build a special roller for the work; this consists of two steel cylinders filled with concrete, with provision for axles and suitable mountings to the frame itself so each unit rolls independently. Heavy timber frames were used to obtain complete rigidity and although the roller weighed approximately 10 tons, it could be readily hauled by a light truck.

A few days after construction of the penetration course, a seal coat at the rate of 1/3 gal. per sq. yd. was applied, followed by covering with fine granite chips at the rate of 10 lbs. per sq. yd. This seal coat also was thoroughly rolled.

Aprons and hangar floors were constructed of the same type of surface as the runways so that the entire paved area is continuous in design. Granite chips used for the final cover are almost white and from the air the paved runways and service areas are sharply defined against the green of the surrounding terrain.



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# United's Radio Network

***HENRY W. ROBERTS***
**Radio Editor**

● To utilize fully the radio range network maintained by the Department of Commerce and the weather service provided by the Department of Agriculture, and to augment them where necessary, each major airline maintains an individual radio system which is an integral part of its organization.

United Air Lines, pioneers in the use of radio as an aid to air transportation, and who, in 1928, under their late radio chief Thorpe Hiscock, developed the first two-way voice communication between ship and ground in scheduled air transport, maintain a comprehensive well-integrated radio department the functions of which are: navigation, weather information, communication, design, maintenance, and research.

### Ground Network

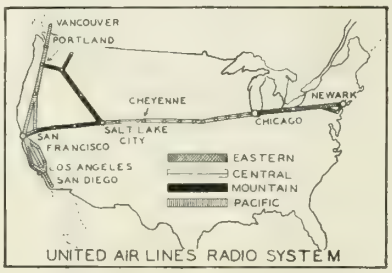
The ground network is comprised of 34 stations divided into 4 frequency divisions: *Eastern* (New York—Chicago); *Central* (Chicago—Salt Lake City); *Mountain* (Salt Lake City—San Francisco and Salt Lake City—Portland and Spokane); and *Pacific* (San Diego—San Francisco—Vancouver and San Francisco—Medford, via Sacramento). Separate day and night radio frequencies are assigned to each division:

| Division | Day | Night |
|---|---|---|
| Eastern ..... | 5572.5 | 3162.5 |
| Central ..... | 5662.5 | 3322.5 |
| Mountain ..... | 5122.5 | 3147.5 |
| Pacific ..... | 5592.5 | 3182.5 |

The division stations (Chicago, Salt Lake City, and Oakland) handle traffic in both directions and provide simultaneous service on the two day or the two night frequencies. In effect they are double stations.

To guard against failure at a division station, the stations nearest it, normally operating on two frequencies, are capable of four-frequency operation to serve both divisions. Such stations, called *interlock* stations, are: for Chicago—Toledo to east, and Moline to west; for Salt Lake City—Rock Springs to east, Elko to west, and Boise to north; for San Francisco (Oakland)—Sacramento to east, Fresno to southeast, and Burbank to south.

At the Portland junction of the Mountain and Pacific frequency divisions (though, administratively, not a division station). 4-frequency operation is also maintained, with Pendleton to east and Seattle to north as interlock stations.




***United's radio system is divided into four frequency divisions***

Operating ground equipment represents eight years of progressive selection. Most of the radio transmitters and receivers are supplied by Western Electric Co. built to United's designs and specifications. Fixed equipment, such as dynamotors, meters, teletypes, are standard manufactured products, tested and approved by the United's radio laboratories.

Aircraft radio design is partly governed by the air line's individual needs. This was recognized by United when they first



***Typical radio ground station***

began building their radio network and constructed their own equipment. To this day their well-staffed and well equipped radio laboratories are actively engaged in the design of new equipment, in improving existing facilities, and in experimental work. Experimental apparatus, almost without exception, is built in their own shops, perfected and standardized, and its manufacture in production quantities is let under contract. Thus United achieves and maintains the degree of excellence of their radio system, perfectly fitted to their special needs. Along their 5000 miles of airways, more than 100 radio stations, on the ground and in the air, function 24 hours a day in closely-knit precision of a single orderly organization.

Servicing of United's ground stations is handled by a traveling crew of 7 service men, functioning independently from the aircraft radio maintenance group. Each ground station undergoes a routine inspection and servicing every six weeks. These service men are divided in two groups—one operating east of Salt Lake City under an engineer stationed in Chicago; the other west of Salt Lake City, under an engineer at Oakland. Deployed over the network, they constantly travel from station to station, and in an emergency several of them can converge at the point of trouble on short notice.

These flying service men are responsible for the care of ground station equipment, including company-owned teletype machines and such items as clocks, weather indicators and mechanical devices related to the operation of the radio station. They carry with them more than 100 pounds of testing apparatus and repair equipment, including a test oscillator, tools, and a supply of parts and hardware.

First step in the service man's procedure is to clean and oil movable parts and test the tubes. He then checks the receivers for sensitivity and accuracy of tuning, using the portable oscillator to generate test signals. Remotely-controlled receivers, employed at many ground stations to avoid man-made static, include a telephone-dial control head and a series of operating relays. These are adjusted to an exact standard in tension and contact clearance by a gramometer tension gauge and specially designed adjusting tools.

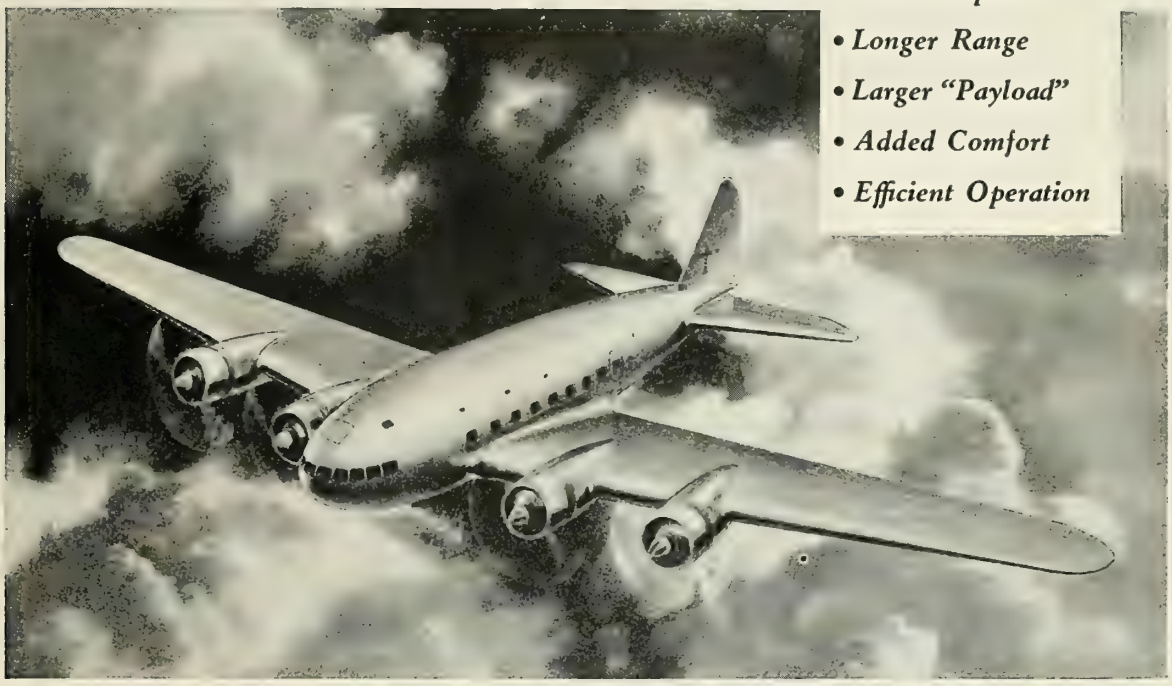
(*Continued on following page*)



***Radio service and construction shop at the Cheyenne base***

# 4-engined Boeings meet *all* these modern needs—*simultaneously:*

- *Greater Speed*
- *Longer Range*
- *Larger "Payload"*
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- *Efficient Operation*





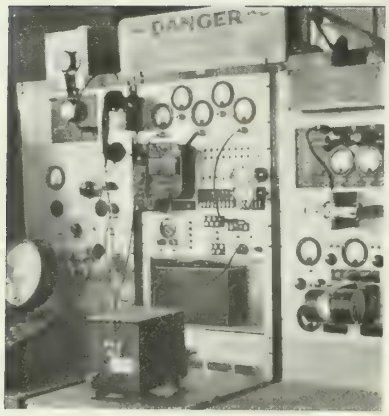

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The modern four-engined airplane, offering the greatest combination of all these qualities ever attained, is Boeing's answer to the exacting requirements of aviation today.

*Boeing has always built tomorrow's airplanes today!*




*Aircraft radio apparatus is inspected and overhauled every two weeks*

(*Continued from preceding page*)

Transmitting equipment is similarly serviced. His work completed, the service man, who must be a licensed radio operator, "sits in" at the ground station controls, to assure himself at first hand that the equipment is functioning properly.

### Flying Equipment

Mobile aircraft radio equipment is standardized throughout the line. Transmitters and receivers are easily removable, mounted on shock-insulated benches with grooves and plug-in electrical connectors, and can be slid in or out of place by releasing a finger spring bolt.

In common with usual practice, transmitters have their day and night working frequencies crystal-controlled. Three receivers are carried on each ship: long-wave beacon, short-wave interline communication (with day and night frequencies crystal-controlled), and a battery-operated emergency receiver.

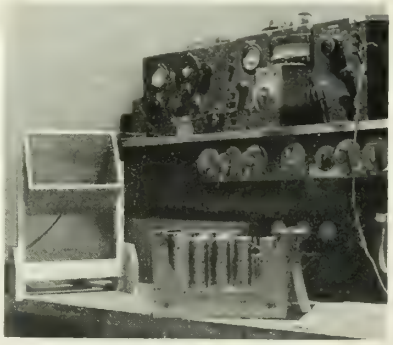
For servicing, the mobile radio equipment is divided in two groups: removable (transmitters and receivers), and fixed (power supply units and permanent wiring). Fixed radio equipment, requiring less frequent attention, is checked at division points as a matter of routine, and is overhauled and serviced at the Cheyenne base when the ship is brought in for engine replacement and general overhaul.

Removable equipment is checked at the end of each flight, together with the rest of the ship, and serviced every two weeks at the division points, when the transmitter and the three receivers are removed and sent to the shop for thorough check and overhaul, and replaced by equpiment previously serviced.

It is the practice of the air line to service their ships in the division where they operate (except for the engine replacement and major overhaul, which is done in Cheyenne). The radio equipment on board the ship is pre-tuned to operate on the day and night frequencies of its division. A ship cannot take off and continue to the next division without having its radio replaced. The twenty minutes to half-hour delay for changing the radio is utilized for an extra thorough check of the airplane, which is obligatory and, because of the time needed for radio change, cannot be inadvertently skipped or abbreviated.

Regardless of satisfactory performance in flight and in the daily checks during fueling and mechanical servicing of the ship, at the end of two weeks the entire radio equipment goes to the division shop for mechanical and electrical overhaul. The preliminary check includes testing impedance, output and electrical efficiency of tubes, tracing all wiring to detect loose connections, inspection and cleaning of switches, relays, other electrical contacts and mechanical parts, and a load test of the emergency all-purpose receiver battery.

The three receivers are then hooked up under operating conditions for an aural test of amplification and tuning, and if satisfactory, they go on for the sensitivity test. In a room completely shielded by fine mesh copper screening to exclude signals of transmitting stations and other electrical interference, a carefully calibrated crystal-controlled signal generator,



*Sensitivity is checked in a special room completely shielded by fine mesh copper screen to exclude extraneous signals*

capable of generating signals to simulate near and distant stations over a wide frequency range, is employed to test the sensitivity of the receivers on long-range reception, and signal quality on short-range reception. The receiver must be finely balanced and capable of receiving a signal as low as 10 microvolts in intensity, or approximately the faint signal of a weak airplane transmitter many miles away, and yet have no tendency to "block" heavy signals on short range, as when two airplanes with powerful transmitters pass each other in flight. Stability of tuning throughout the receiver range, as well as on the crystal-controlled frequencies, is also checked.

The transmitter, after a check and overhaul of tubes, wiring, relays, frequency-change mechanism, and mechanical parts, is wired for operation. Using a dummy antenna, matched to the exact electrical equivalent of the ship's antenna, the service man listens in with a special pick-up to test the quality of the transmitter's modulation. Then follows the final check for faulty components, which is an over-voltage test with the transmitter operating at a 50% voltage increase, to show up any defective condenser or tube that might have escaped detection in meter checking.

Overhauled transmitters and receivers, their history and the history of their component parts recorded on "log cards," then go into the division stock room.

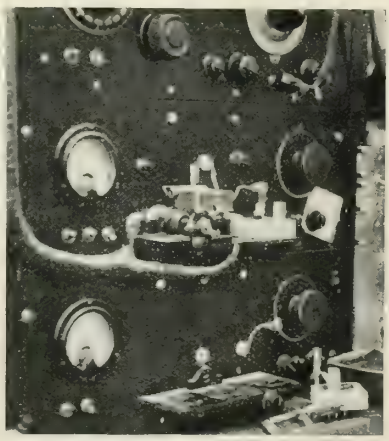
Operation of such a system for mobile equipment overhaul necessitates a large number of units. At present, United's operations and maintenance program calls for a stock of 90 sets of two-way voice short-wave transmitters and receivers for interline communication, 100 long-wave beacon receivers, and 75 all-purpose emergency receivers. A supply of 85 transmitter power supplies and 85 receiver power supplies is always on hand. 2500 tubes are required for mobile aircraft radio alone; 1000 are in daily operation.

Ground radio equipment lists thirty-four 400-watt transmitters and 78 ground receivers for contacting aircraft. In addition, there are 20 long-wave receivers for checking radio ranges and listening to the landing procedure (airport traffic control rooms operate on 278 kc.). Fifteen all-wave receivers for contacting itinerant fliers where United operates localizer beacon stations complete the ground equipment. The ground system requires 3300 tubes, of which 1600 are in daily operation, 1400 in replacement stocks at stations, and another 300 in division stockrooms at Chicago, Salt Lake City and Oakland.

### UAL Radio Research

United's radio laboratories, at Chicago, are responsible for the design and operating practices of the air line's radio system. Fully equipped and well staffed, they are capable of designing, building, testing and perfecting new radio equipment to fit new needs. While new airplanes (such as the Douglas DC-4) are being

(*Continued on page* 92)



*Crystals are checked for frequency stability over a wide temperature range*




# GOOD WORK, AMERICAN AIRLINES!

Western Electric congratulates you on being the first air line to carry one million passengers—and wishes you the best of luck with your second million!

# GOOD WORK, EASTERN AIR LINES!

Western Electric congratulates you on winning the National Safety Council Certificate of Special Commendation by flying 141,794,894 passenger miles (1930-1936) without a fatality!




## P. S.

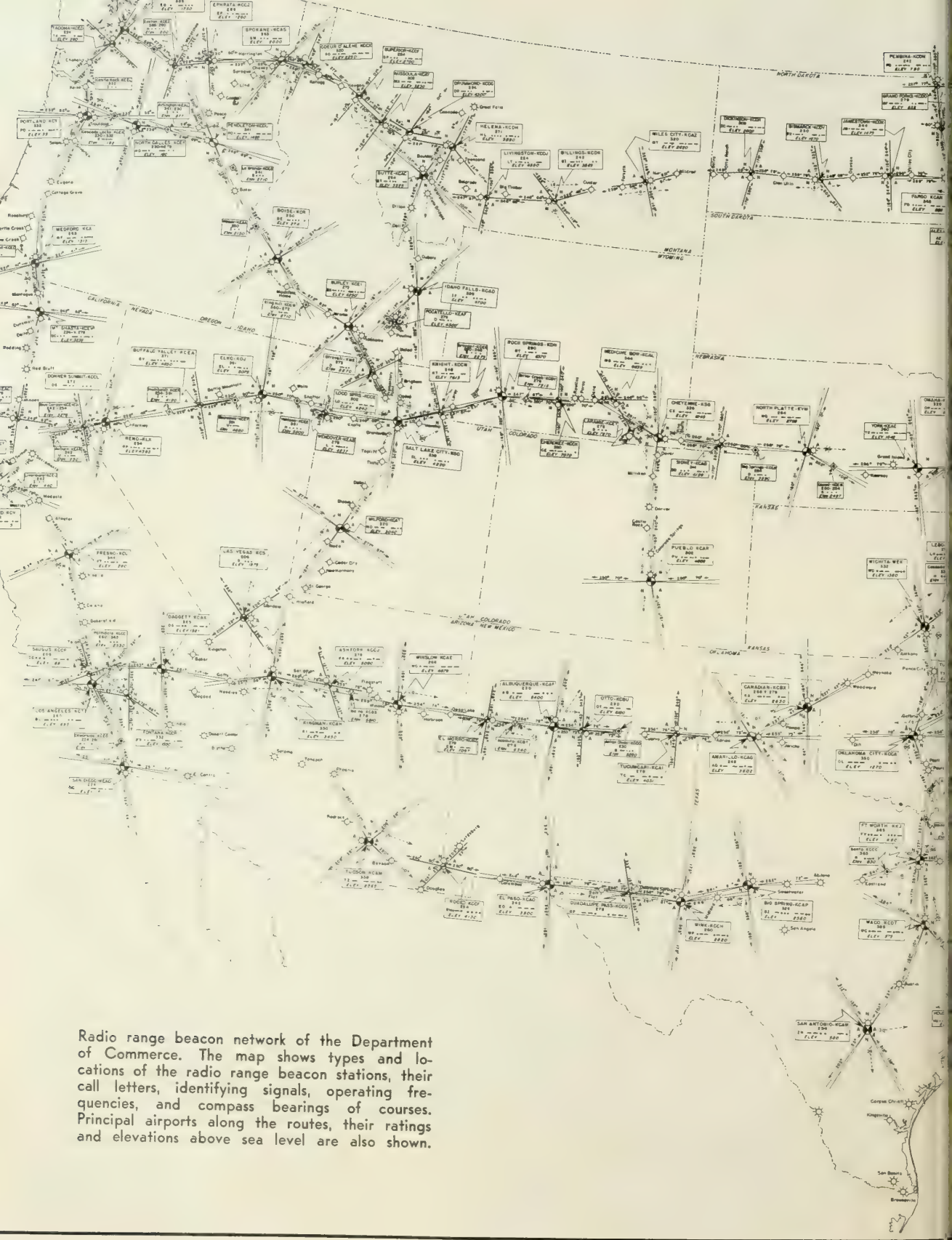
Western Electric is proud of the part its radio telephone equipment has played in making possible these two splendid achievements. Day and night, year after year, it has provided dependable communication on American, Eastern and all other major U. S. air lines.

For details of equipment for transports, private planes or airports, write to Western Electric, Dept. 309AD, 195 Broadway, New York.

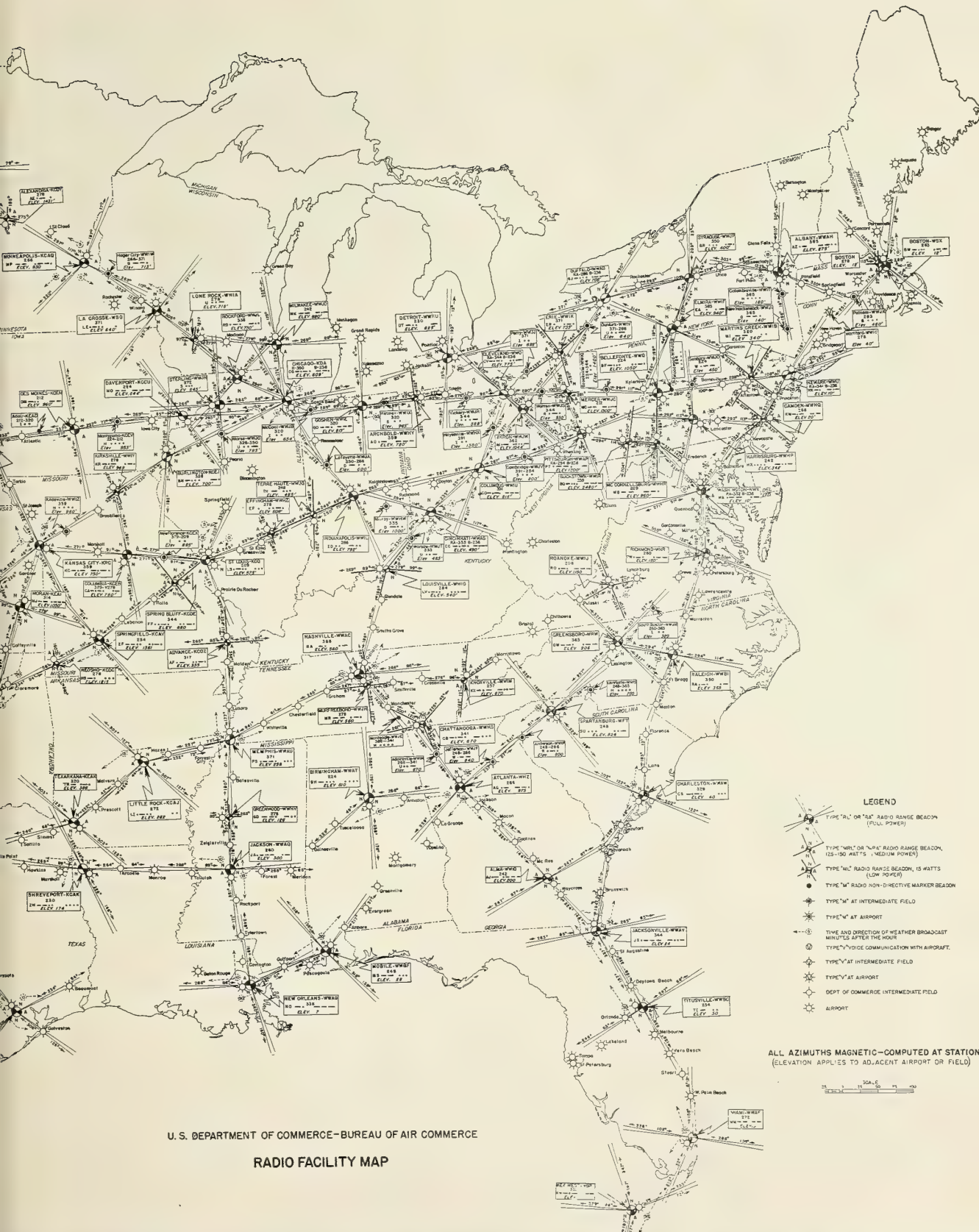
**Western Electric**

In Canada: Northern Electric Co., Ltd.

TWO-WAY AVIATION RADIO TELEPHONE AND TELEGRAPH EQUIPMENT

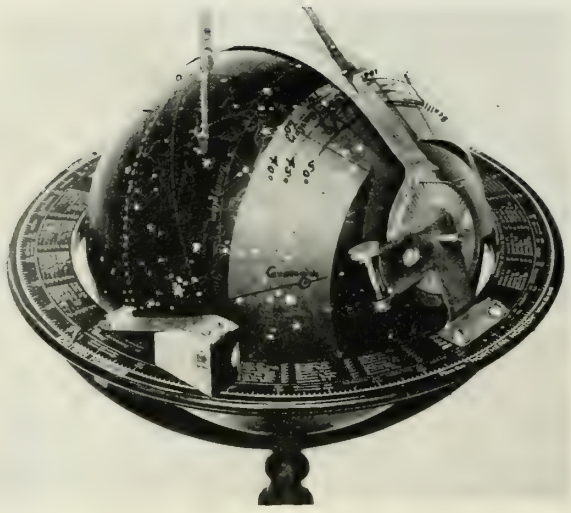


Radio range beacon network of the Department of Commerce. The map shows types and locations of the radio range beacon stations, their call letters, identifying signals, operating frequencies, and compass bearings of courses. Principal airports along the routes, their ratings and elevations above sea level are also shown.


LEGEND
TYPE "RL" OR "RA" RADIO RANGE BEACON (FULL POWER)
TYPE "MRL" OR "MRA" RADIO RANGE BEACON, 125-150 WATTS (MEDIUM POWER)
TYPE "ML" RADIO RANGE BEACON, 15 WATTS (LOW POWER)
TYPE "M" RADIO NON-DIRECTIVE MARKER BEACON
TYPE "M" AT INTERMEDIATE FIELD
TYPE "M" AT AIRPORT
TIME AND DIRECTION OF WEATHER BROADCAST MINUTES AFTER THE HOUR
TYPE "V" VOICE COMMUNICATION WITH AIRCRAFT.
TYPE "V" AT INTERMEDIATE FIELD
TYPE "V" AT AIRPORT
DEPT OF COMMERCE INTERMEDIATE FIELD
AIRPORT
ALL AZIMUTHS MAGNETIC—COMPUTED AT STATION
(ELEVATION APPLIES TO ADJACENT AIRPORT OR FIELD)
SCALE
MINNEAPOLIS-KCAG
LA CROSSE-WSQ
LONE ROCK-WHIA
MILWAUKEE-WMQ
CHICAGO-KDA
DAVENPORT-KCCU
DES MOINES-KDEN
OMAHA-KEAD
KANSAS CITY-KMC
ST LOUIS-KSD
SPRINGFIELD-KCAV
SPRING BLUFF-KGOE
ADVANCE-KCOI
NEOSHO-KGOC
TEXARKANA-KCAR
LITTLE ROCK-KCRJ
SHREVEPORT-KCAK
JACKSON-WMAQ
MEMPHIS-WMAU
NASHVILLE-WMAC
BIRMINGHAM-WMAT
GREENWOOD-WMWY
NEW ORLEANS-WMAG
MOBILE-WMBF
ATLANTA-WMZ
CHATTANOOGA-WMWG
KNOXVILLE-WMYM
LOUISVILLE-WMIQ
INDIANAPOLIS-WMIL
TERRE HAUTE-WMJO
ARCHBOLD-WMMY
DETROIT-WMYU
GRAND RAPIDS-WMAQ
CLEVELAND-WMJW
ERIE-WMYA
BUFFALO-WMAD
ROCHESTER-WMAK
SYRACUSE-WMJO
ALBANY-WMAN
BOSTON-WSX
BOSTON-WF
CONCORD-WMAF
PORTLAND-WMAE
BANGOR-WMAH
MONTPELIER-WMAL
BURLINGTON-WMAM
NEW HAVEN-WMAQ
HARTFORD-WMAS
PROVIDENCE-WMAF
NEW YORK-WMCA
NEWARK-WMAC
CAMDEN-WMMG
PHILADELPHIA-WMAN
HARRISBURG-WMAD
WILKES-BARRE-WMAV
PITTSBURGH-WMAQ
MC CONNELLSBURG-WMHR
WHEELING-WMAJ
COLUMBUS-WMJJ
DAYTON-WMJD
RICHMOND-WMJR
ROANOKE-WMJJ
GREENSBORO-WMFW
RALEIGH-WMBI
SPARTANBURG-WFT
CHARLESTON-WMBW
JACKSONVILLE-WMAY
TITUSVILLE-WMBC
MIAMI-WMAY
ORLANDO
TAMPA
ST PETERSBURG
KEY WEST-WDP
MOBILE
NEW ORLEANS
HOUSTON
GALVESTON
BEAUMONT
SHREVEPORT
TEXARKANA
LITTLE ROCK
JACKSON
MEMPHIS
NASHVILLE
BIRMINGHAM
ATLANTA
CHATTANOOGA
KNOXVILLE
LOUISVILLE
INDIANAPOLIS
TERRE HAUTE
ARCHBOLD
DETROIT
GRAND RAPIDS
CLEVELAND
ERIE
BUFFALO
ROCHESTER
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HARTFORD
PROVIDENCE
NEW YORK
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PITTSBURGH
MC CONNELLSBURG
WHEELING
COLUMBUS
DAYTON
RICHMOND
ROANOKE
GREENSBORO
RALEIGH
SPARTANBURG
CHARLESTON
JACKSONVILLE
TITUSVILLE
MIAMI
ORLANDO
TAMPA
ST PETERSBURG
KEY WEST

# Fixing Positions In Air Navigation

JOSEPH M. GARDNER



*Device developed from a commercial Star globe which permits the sub-stellar points for stars to be fixed for any instant that observations may have been made*

● Finding one's position on the earth from observations of the apparent positions of celestial bodies is a problem easily understood by those familiar with simple geometry. The method here described is not in general use at present, but it will help the beginner to understand the problem and, with the instrument illustrated here, gives good approximate results.

In figure 1, the "sub stellar point" is the point vertically beneath a star at the time it was being observed by someone at the "observer's position." The observer, with the conventional sextant, measures the angle between his line of sight and the vertical. This angle is the angular distance from the sub stellar point to the position of the observer and, if the location of the sub stellar point is known, it would appear to be a simple matter to measure over on a globe and find the observer's position. If, however, figure 1 is rotated about the line AA until the points referred to are as in figure 2, one wonders which direction to measure. When sextants are built to read azimuth, this direction will be known and the observer's position can be located directly. Using the conventional sextant, it is necessary to draw a small arc around the sub stellar point with radius equal to the distance measured by the sextant. If one knows his position approximately, he may draw only a short arc and yet be sure it contains his position. A second similar arc drawn about the point beneath a second similar star and intersecting the first will fix the observer's position at a point.

There are several sextants by means of which satisfactory observations can be made. The next most important problem is the location of the sub stellar point. The latitude (declination) and west longitude (Greenwich hour angle) of this point may be found tabulated in the *American Nautical Almanac*, published annually by the Naval Observatory for any year, month, day and hour, and, by interpolation, for any minute or fraction of minute; but, in the device illustrated here (adapted from a Rand McNally commercial star globe) the sub stellar points for the most prominent stars are marked for 4:50 o'clock Greenwich sidereal time on a globe which rotates inside a map globe. Ten minutes later, at 5:00 o'clock, each of these points will have moved westward 2½°, and, if the pin shown in the photograph on the equator and on the Greenwich meridian is placed in the next lower hole, on the 5:00 o'clock line, all these points are correctly located for 5:00 o'clock. With a micrometer screw underneath this pin (but not shown) time can be set to minutes and seconds. Thus the sub stellar points for all stars likely to be observed can be correctly located for any time that an observation may have been made simply by placing the Greenwich time on the Greenwich meridian with the pin and micrometer screw mentioned.

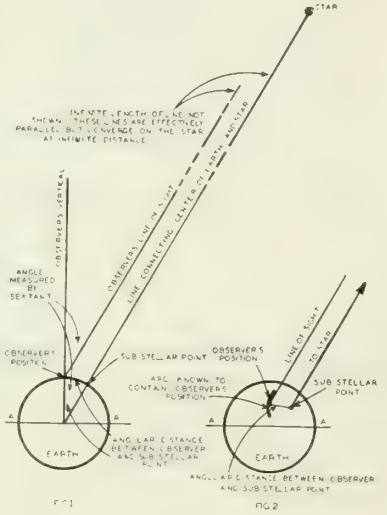



FIG. 1 FIG. 2

Having located the sub stellar point, it is then only necessary to set the angle between the observer's vertical and his line of sight (the zenith angle) as measured with the sextant, accurately on a compass and draw the arc containing the observer's position. Since it is usually desired to place this line on a map, the latitudes and longitudes of two or more points on the arc are desired and may be read on the meridian band. This band can be rotated by degrees and minutes so as to represent any meridian and the latitude at which the position arc crosses the meridian is read directly, and the point can be placed on the map. The position arc can be drawn on the map when two or more of its points are plotted.

### Use as Star Finder and with Sun

This device is its own star finder. It often happens, when the sky is partially obscured, that a star may be sighted but cannot be identified. If the observer's position is known approximately, the altitude and the approximate azimuth of the star is observed, and the measurement may be made from the observer's approximate position to locate and identify the sub stellar point and then a precise measurement can be made from this point to locate the observer more accurately.

This device can be used with the sun in either of two ways. The sun may be located among the stars according to date as marked on the dotted line, which crosses the equator at the zero time point and makes an angle of approximately 23° with the equator, and then used exactly as though it were a star. It can also be placed on the 12:00 o'clock line and moved N or S by a date scale to account for its declination, and E or W by the amount of the equation of time, and then used just as though it were a star except that Greenwich civil time, instead of Greenwich sidereal time, is used.

### Precession and Aberration Errors

Due to the precession of the earth's axis and also to apparent change in positions of stars caused by the motion of the earth in its orbit (aberration of light), the actual and apparent declination and right ascension (east longitude as referred to the zero time line) are continuously changing, but, for air navigation, these errors may be ignored for periods of a few years and then may be corrected by re-spotting the sub stellar points on the globe.



***For your own satisfaction, check the comparative advantages of the new and more* MODERN METAL**

# Phantom

CHECK AND TOTAL THE SCORE IN COMPARISON WITH ANY OTHER PLANE

| | | Phantom | Other |
|---|---|---|---|
| 1 | Eye appeal | √ | |
| 2 | Full monocoque fuselage | √ | |
| 3 | Metal spars and ribs | √ | |
| 4 | Fire resistance | √ | |
| 5 | Low maintenance of metal | √ | |
| 6 | Long life of metal | √ | |
| 7 | High resale value | √ | |
| 8 | No wood, no nails, no glue | √ | |
| 9 | Stainless steel flaps | √ | |
| 10 | Both manual & electric flap control | √ | |
| 11 | Oil temperature control | √ | |
| 12 | Shock mounted instruments | √ | |
| 13 | Army-Navy specification instruments | √ | |
| 14 | Landing lights, standard | √ | |
| 15 | Bonded for radio, standard | √ | |
| 16 | Non-magnetic control columns | √ | |
| 17 | Electric accessories individually fused | √ | |
| 18 | All metal parts plated | √ | |
| 19 | Ball bearing control throughout | √ | |
| 20 | Genuine leather upholstery, standard | √ | |
| 21 | Parking brake | √ | |
| 22 | Tail wh. lock for cross wind landings | √ | |
| 23 | Minimum of welded parts | √ | |

| | | Phantom | Other |
|---|---|---|---|
| 24 | Navigation lights, standard | √ | |
| 25 | Aluminum conduits for all elec. wiring | √ | |
| 26 | Eight cubic feet luggage space | √ | |
| 27 | Seats ready for parachutes | √ | |
| 28 | Die cut parts all interchangeable | √ | |
| 29 | Easy removal of fillets for inspection | √ | |
| 30 | Motor driven generator | √ | |
| 31 | Rear cabin window | √ | |
| 32 | Battery protection against heat | √ | |
| 33 | One hundred forty m.p.h. cruis'g speed | √ | |
| 34 | Forty-five m.p.h. landing speed | √ | |
| 35 | Five hundred fifty miles cruis'g range | √ | |
| 36 | Optional colors, no extra charge | √ | |
| 37 | Oildraulic tail wheel | √ | |
| 38 | Engagement of flaps at any speed | √ | |
| 39 | Designed for 294 m.p.h. diving speed | √ | |
| 40 | Fuselage static test load of nine tons | √ | |
| 41 | Easily removable gas tanks | √ | |
| 42 | Baggage accessible in flight | √ | |
| 43 | Selective cabin temperature control | √ | |
| 44 | Seventeen miles per gallon | √ | |
| 45 | Metal propeller | √ | |
| 46 | Electric starter | √ | |

LUSCOMBE AIRPLANE CORPORATION
WEST TRENTON NEW JERSEY

# Low-Pressure Type Fuel Injection System

## A mixture control designed for aircraft engines in varied service including flight at high altitudes

● The low pressure fuel injection system which has been developed by Marvel-Schebler Carbureter Division of Borg-Warner Corp., is designed for mixture control when used in conjunction with aircraft engines. While this description covers the injection system as developed for the Continental W-670 engine (which has been granted ATC 168 approving its use as standard equipment on this engine), much of the following is devoted to general functioning of the system as applied to engines in varied service, with the addition of the mixture control which is applicable primarily to engines intended for flight at high altitudes.

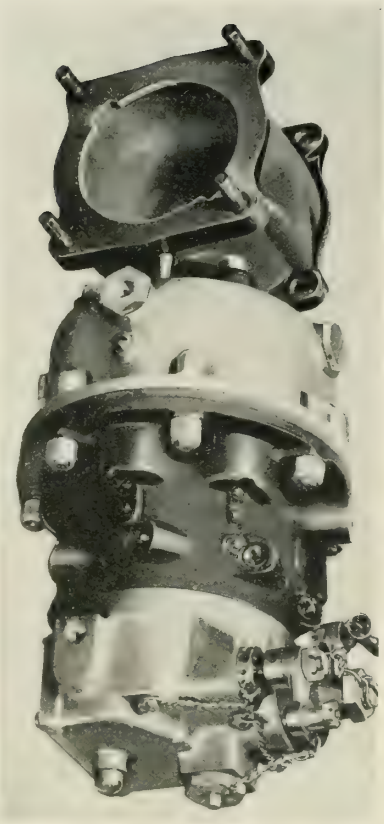
### Pumpage of Fuel

Fuel pumpage is by plungers closely fitted in pumping bores provided in a unit cast injector body. Inlet and discharge valving is provided by imparting a reciprocating and an oscillating motion to these plungers both motions being simultaneous and imparted to all of the plungers progressively, the cycle being repeated each revolution of the drive cam. These motions allow a duct in the tip of the plunger first to register with an intake port, after which the plunger is urged downward by a spring over its foot to induct the fuel. With the fuel inducted, the plunger is then oscillated so that the duct in the tip registers with a discharge port which is tube-connected to the spray nozzle. In this position the plunger is forced upward to displace the fuel into the discharge tube and through the spray nozzle to supply the engine.

### Leakage Prevention

The plunger is also provided with a groove, farther from the tip, in which any fuel film working down its side is arrested and returned to the fuel chamber. Below this fuel return groove is a second groove, supplied with oil under pressure from the engine oil line, to serve as a seal against further fuel creepage and also to lubricate the lower part of the plunger. As the pressure in this groove is higher than that of fuel in the upper groove, any leakage between grooves is that of oil working upward.

Reciprocation and oscillation of the plungers is caused by the drive cam rotated in the bearing housing. The cam is of the swash-plate type with the one plane face at an angle to the axis furnishing the reciprocating motion. The actual motion transmitted to the plungers is through sliding type cam followers and the stroke of the plungers is determined by arresting the plungers' return with a stop plate thus causing the ball head on the follower to leave the socket in the foot of the plunger as the follower rides the cam. On the next rotation the up slope of the cam again raises the follower and, after taking up the slack between the ball end on the follower and the socket in the plunger, lifts the plunger from the stop plate to effect its discharge stroke. The length of the stroke is thus regulated by the location of the stop plate and with the stroke determined, the plate is locked in place. The stroke of the plunger is thus constant as set to supply the wide open fuel requirements of the engine.



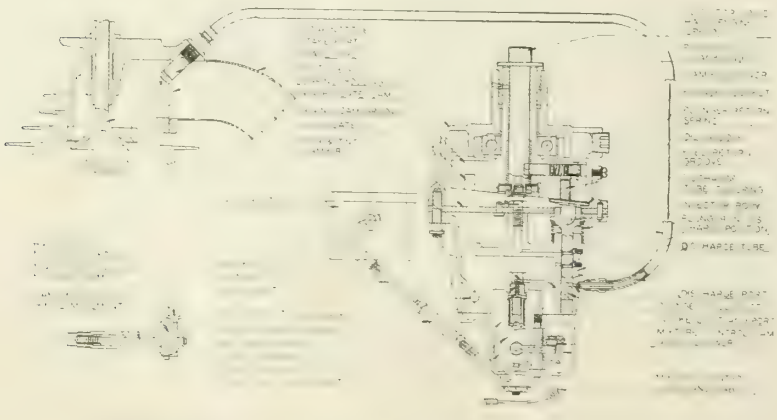
*7-cylinder Marvel fuel injector designed for Continental engines*

### Plunger Oscillation

Oscillation of the plunger, which effects the valving at its tip, is secured by having a crank end on the plunger trailing in an eccentric groove sunk into the top face of the swash plate cam. The eccentricity of the groove swings the crank through a definite arc and the duct in the tip of the plunger is made to register with the intake and discharge ports at the limits of the arc.

Fuel supply is by pump, recirculation being obtained by a return line to the fuel tank. Metering for all of the pumping

(*Continued on following page*)



*Schematic cross-sectional diagram showing the arrangement and functioning of parts comprising the Marvel fuel injection system*

# UNITED AIR LINES' "MAINLINERS"




## ARE EQUIPPED WITH

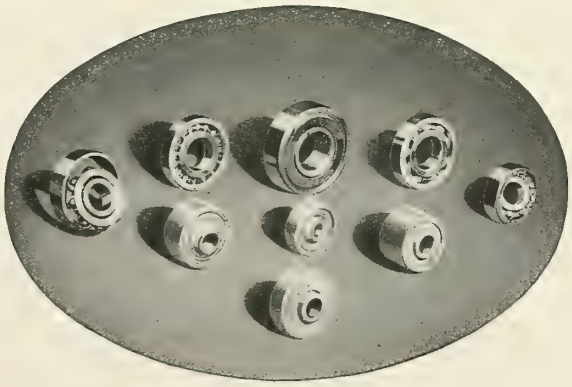
## "NORMA-HOFFMANN"

## PRECISION BEARINGS

With the authority of 10 years' flying experience and a flying record of over 100,000,000 miles, United Air Lines describe their new Douglas-built "MAINLINERS" as "America's most luxurious land planes, now affording a 15⅓-hour 3-stop California-New York service." Of this new fleet, ten are 21-passenger club-type day planes, ten are deluxe 14-passenger "Skylounge" planes, and eight are sleeper planes. * * * * In the controls of all of these, in keeping with the best standards making for speed and dependability, are NORMA-HOFFMANN PRECISION BEARINGS, which are also employed in the two 1150 H.P. Pratt and Whitney "Wasp" engines; in the Sperry gyropilot; and in the Pioneer and Kollsman instrument equipment.

*"Where the bearings must not fail"*—on land, at sea, and in the air—NORMA-HOFFMANN Precision Bearings are the choice of engineers and designers of planes, engines (including superchargers), engine accessories, control apparatus, instruments, radio equipment, cameras and landing field equipment.

The NORMA-HOFFMANN PRECISION line of ball, roller and thrust bearings comprises 108 distinct series embracing over 3000 catalogued sizes (including the aircraft control bearings pictured below)—a PRECISION BEARING for every load, speed and duty in aviation service. Write for the Catalog and special Aircraft Control Bulletin. Let our engineers work with you.



NORMA-HOFFMANN BEARINGS CORPORATION, STAMFORD, CONN., U. S. A.

PRECISION BALL, ROLLER, AND THRUST BEARINGS

(*Continued from preceding page*)
units is effected at a common center on the intake side, by a needle-controlled orifice in the inlet passage from the fuel supply chamber.

Actual metering is into some 18″-20″ of vacuum, the pump plungers producing the vacuum, while the head and atmospheric pressure on the fuel outside the metering orifice forces the fuel through the variable orifice to overcome the vacuum. It is the uniformly distributed fuel, expanded at the metering orifice, which meters the fuel into the vacuum, the pumps positively forcing into the discharge lines any amount of fuel which is metered. This continuously expanding fuel, in which the size of the expanded particles is inversely proportional to the size of the metering orifice or annulus, always fills the distributing chamber and intake ducts as well as the displacement of the pump under suction, and is recompressed on the compression stroke of the pump.

### Compensation for Loads

Both the air throttle controlling the air induction of the engine on the intake side, and the fuel needle controlling the fuel metered on the intake side are interconnected and open and close together. The fact that the metering is on the suction side of the pumping units, as is the air throttle on the intake side of the engine cylinders, makes the fuel and air inherently self-compensating for variable load. Thus with the air throttle and the metering needle (which is connected to it) held in one position for a certain propeller load, if the load is reduced and the engine revolutions increase as they would by turning the nose of the ship downward and increasing the forward speed, substantially the same fuel and air is divided among more cylinder inductions and each individual charge is correspondingly smaller. Inversely, if the speed is pulled down with load, as it would be with the slower forward speed of a climb, again substantially the same amount of fuel and air is divided among less cylinder inductions and each inducted charge is correspondingly larger. This so-called "time element" of the metering orifice and the air throttle provides fuel-air compensation for varying loads.

Part throttle fuel-air proportion is maintained by positive linkage between the air throttle and the injector in which is incorporated a fuel-air cam which is effective throughout the range to wide open throttle.

### Idling Adjustment

For idling mixture adjustment a means is provided to raise or lower the fuel-air cam, and for initial set-up the link can be adjusted. The fuel-air cam is generated by taking for each degree of rotation of the air throttle the lift of the metering needle which will give the correct proportion of fuel to air. The fuel-air cam made from this rotation lift table is then applicable to engines of about similar characteristics.



*Installation of the Marvel fuel injector on the Continental engine*

For aircraft engines the fuel-air cam is a warped surface arranged to be moved axially, and this axial movement provides a manual mixture control for lower air density at increased altitude. The surface of this cam is generated by taking the correct fuel-air cams for the leanest and for the richest limits and warping the surface between them. Thus an infinite number of theoretically correct cam contours are generated between these end limits and only the axial movement of the cam is needed to select the correct fuel-air proportion for the air density in which the engine is operating.

### Spray Nozzles

A tube leads to a spray nozzle in an engine intake port from each discharge outlet of the injector. The spray from the nozzles may be directed either with or against the air stream, the result, due to the timing with the induction of the engine, being virtually the same as far as the mixing of all of the air and all of the fuel is concerned. Spray nozzles are of the tangential-duct, whirl chamber type and the fuel is finely atomized by being torn asunder centrifugally into myriads of small particles having low penetration. This soft spray is in the shape of a wide angle cone and the air then being inducted can easily get into the interstices between the fuel particles inasmuch as they are carried toward and through the open intake valve.

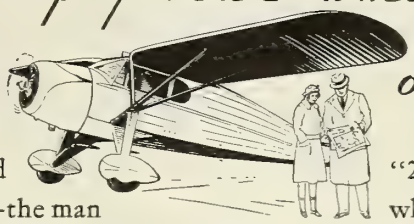
Due to the great amount of surface, which is exposed by the many fuel particles, evaporation of the fuel is high in this area and a substantial temperature drop results therefrom. This causes a heavier weight of charge to be inducted, which accounts for the power increase with the same compression ratio.

### Smoothness and Economy

The fine atomization and equal fuel distribution, as between cylinders, provides smoothness of operation and fuel economy throughout the range. The fact that the system is sealed and is at all times filled with fuel makes it non-directional, thus giving dependable operation in any attitude. Jets located at the individual ports of the engine, with an instant increase of finely atomized fuel on throttle opening, also account for instant acceleration. This location of the spray jets also causes the vaporizing fuel to be in the combustion heated intake ports, where the water vapor likely to be present cannot precipitate and freeze.

In 350 hours of winter flying tests, areas of high humidity and low temperature were repeatedly encountered, but, without outside application of heat which would have affected power output, no trouble was experienced from manifold icing.

# *Most popular among owners who do their own flying*



The Fairchild "24" was designed for the private flyer--the man who desires an airplane for personal transportation. In this field it has achieved a wide popularity--(1) because it is a delightful airplane to fly; amateurs and experts feel equally at home in it; (2) because it combines quick take-off, rapid climb, excellent ceiling and marvelous landing control with a two-mile-per-minute cruising speed; (3) because an average fuel consumption of nine gallons per hour spells real economy; (4) because it incorporates the highest standards of quality construction--*FAIRCHILD STANDARDS!*





The Standard "24"—Warner powered—featuring the highest payload in its horsepower class, accommodates four people with forty gallons of fuel, baggage and accessory allowance. Its amazing take-off and climb, its ability to get in and out of the smallest fields, plus a fly-away price of $5,290 (the lowest priced 4-place cabin in America) make it an outstanding value for any type of operation. Write for full details.

The Ranger powered "24" embodies numerous features which are distinctly appealing to the private owner. In design the in-line engine—with its small frontal area—lends a sleek, racy appearance. In operation, the vibration-free power, the absence of routine valve checks, the engine-driven generator, cabin operated gas drain and oil temperature controls are refinements which add greatly to flying pleasure.

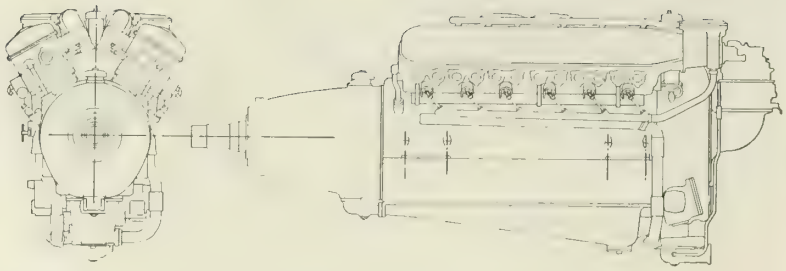
These features, combined with superb construction and splendid flight characteristics, mean confidence, economy of operation and maintenance—and a feeling of being perfectly at ease while flying. All Ranger powered models are of the De Luxe type—featuring exceptionally attractive exterior and interior combinations—styled by Loewy.

# FAIRCHILD

## *Aircraft Corporation*

**HAGERSTOWN. MARYLAND.**

# Allison 1000 HP chemically-cooled Model 1710 Engine



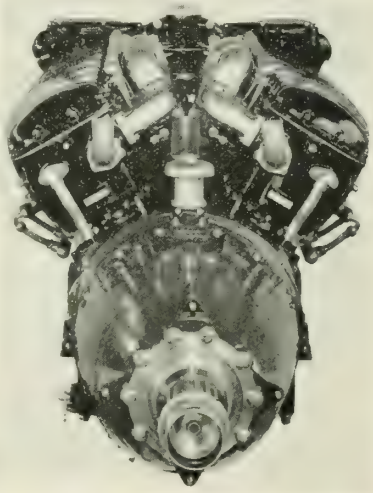
● After practically five years of development and construction, the Allison 1710 engine became the first power plant to pass the U. S. Army Air Corps 150-hour type test for engines of 1000 hp or more. Featuring a number of construction refinements, this engine has been specifically designed for chemical cooling, the coolant being Ethylene Glycol which has a boiling point of 380°F.

A geared 12-cylinder 60° V-type with a 1710 cu. in. displacement, the Allison engine delivers a normal and take-off output of 1000 hp at 2600 rpm using 87 octane fuel. It is adaptable for high altitude work as it permits a practical installation of a turbo supercharger; this device, sponsored by the Air Corps, comprises a turbine compressor driven by the waste exhaust gases of the engine. The engine is normally supplied with a centrifugal type supercharger which is part of the accessory housing. The turbo supercharger can be located immediately under, or to either side of the engine with a short exhaust line, and short air pressure lines to the inter-coolers and the carburetor.

Construction of the Allison 1710 is of a cast aluminum upper and lower crankcase and two 6-cylinder blocks, each consisting of a single aluminum alloy casting containing the combustion chambers and valve mechanism and into which the heat-treated steel cylinder barrels are fitted.

Four Rich-type valves per cylinder are driven by an overhead camshaft completely enclosed and flooded with oil. Valve mechanism accessibility is provided by a single cast magnesium alloy cover extending the length and breadth of the cylinder head. The cylinder barrels, valve seats and valve guides are pressed and shrunk into the cylinder head castings. Valve seats and valves are Stellite faced.

Each of the cylinder blocks consisting of the aluminum head, 6 steel barrels and a cast aluminum jacket are mounted to the upper half of the crankcase by 14 long stud bolts extending through the head and into the case. This construction results in the power forces being transmitted to the crankcase which in turn is stiffened by the truss construction formed by its combination with the cylinder heads and barrels.



*Views of the 12-cylinder Allison 1000 horsepower engine*

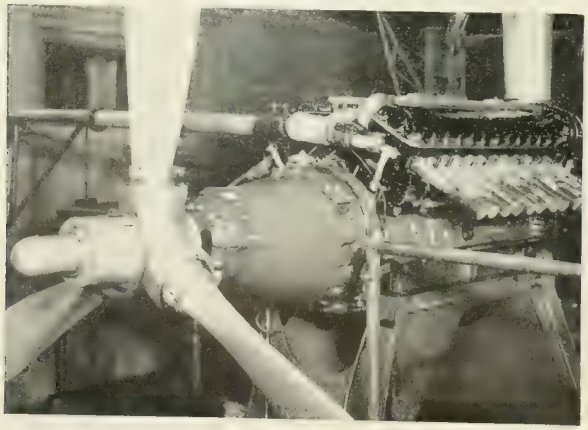
The overhead camshaft is driven through beveled gears through the medium of a long slender shaft in the upper part of the crankcase which is driven by a 2:1 reduction gear. This long shaft has relative high flexibility and results in a valve actuated mechanism free from torsional disturbances.

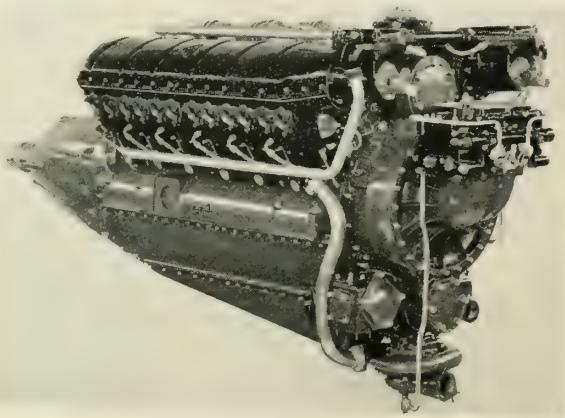
Crankshaft is a chrome nickel molybdenum steel forging of conventional 6-throw type, all surfaces being lapped or polished. Crankshaft journals are hollow and fitted with removable aluminum alloy plugs, and counter-weights are welded to the forged shaft. The propeller reduction gear pinion is splined directly to the front end of the crankshaft, and a spur gear is splined to the rear end of the crankshaft driving the oil pump, coolant pump, fuel pump, vacuum pump and generator, as well as the engine starter. The engine is equipped with a vibration friction damper at the front end and dynamic torsional balancer at the rear end, thus providing for a large range of over-speed without detrimental vibration.

Reduction gear consists of an internal spur gear bolted to the propeller shaft by a flange which is integral with the shaft. A large single piece steel back bronze bearing completely encircles the external diameter of the internal gear. The reduction gear together with the propeller shaft are encased in a single aluminum alloy casting which forms the nose of the engine. This in turn pilots into and is stud fastened to the upper and lower crankcase assembly.

Propeller shaft assembly located in the

(*Continued on page* 88)





# New Boeing Four-Engined Transports

● Work is now in progress at the Boeing Aircraft Co. plant, Seattle, Wash. on a 4-engined flying boat for operation over trans-oceanic routes, and a 4-engined landplane, a modified version of which will be fitted for operation in the sub-stratosphere.

Larger than any commercial landplane now in service on the airways in this country, the new Boeing landplane, known as Model 307, and the high altitude version of it, will be identical except for the installation of supercharging equipment.

Accommodations for 32 passengers will be provided in these landplanes which also will be equipped alternately to carry 26 passengers—18 in upper and lower berths and 8 others in sleeper chairs. They will carry a crew of 4 and also have capacity for approximately 3700 lbs. of mail and express.

Model 307 will have a gross weight of 42,000 lbs. Its wing span will be 107 ft., length 74 ft., and overall height more than 17 ft. Power will be supplied by four 1100 hp single-row radial Wright G-100 series Cyclone engines, each of which develops 1120 hp at 2400 rpm for take off.

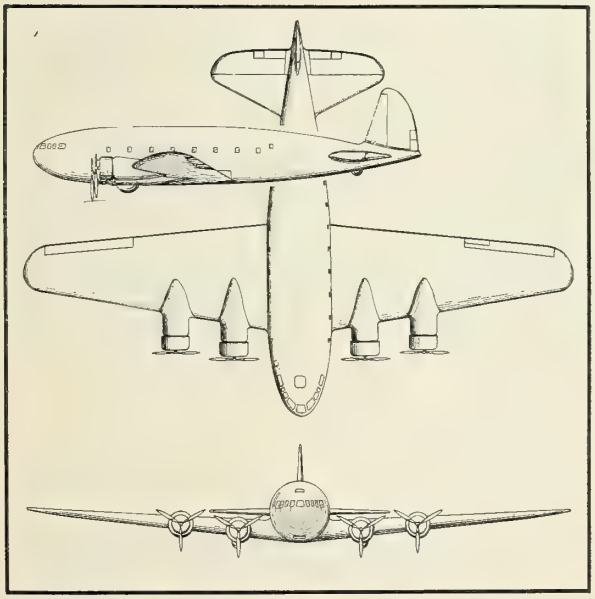
Construction follows all-metal, low-wing cantilever design. Landing gear and tail wheel will be retractable and equipped with air-operated brakes. The fuselage will be cylindrical in section, tapering from the nose to the tail and giving a streamlined shape, including even the windows of the forward control cabin. Behind the control room is a passenger baggage compartment which is accessible in flight; other compartments for mail and express are beneath the floor. Washrooms are located forward of the main passenger cabin as well as at the rear. The galley is also at the rear.

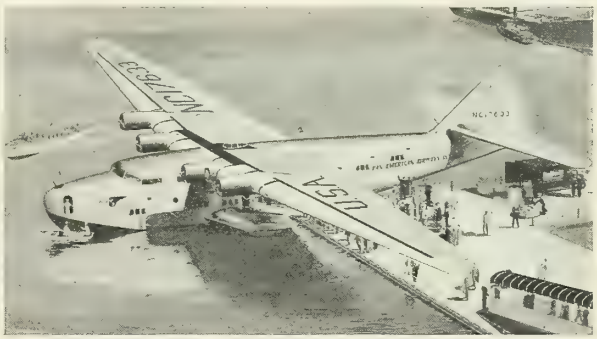
In the stratosphere-type transport, passenger and crew compartments will be entirely sealed by a pressure-tight skin, reinforced windows and pressure doors. These units are built for a design pressure of 6 lbs./in.$^2$ and an operating pressure of 2.5 lbs./in.$^2$ differential between outside and inside air. Two newly-developed mechanical superchargers, each operating on a fraction of the horsepower of one engine, will draw the air through intake valves along the leading edge of the wings, building up its pressure for introduction into the cabin. After the air is pumped through the wings, it will be uniformly distributed through ducts into the cabin, and will then be drawn into an anti-pressure chamber to the rear of the cabin where exhaust valves will be located. It is estimated that at an altitude of about 20,000 ft., passengers and crew will enjoy conditions comparable to those at 8,000 to 12,000 ft.

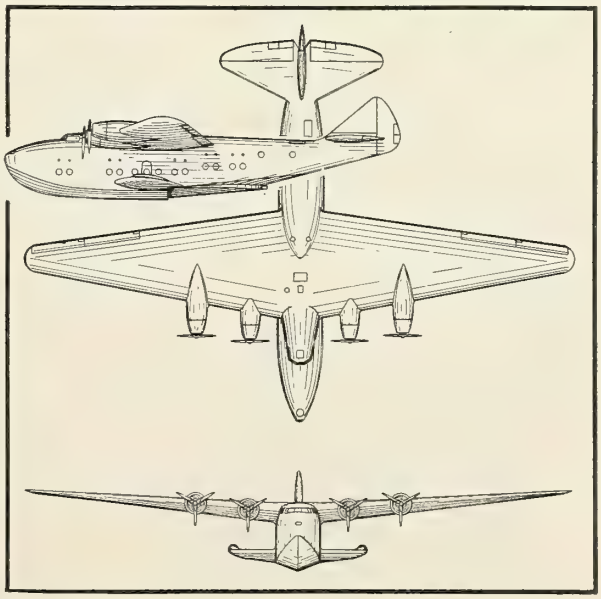
In operation at the higher levels, the Boeing landplane is capable of a speed of approximately 250 mph.

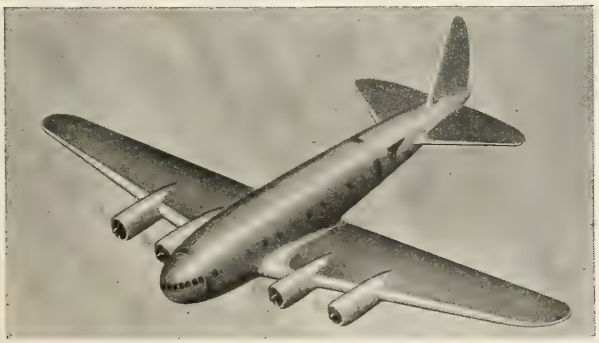
The new flying boats, known as Model 314, six of which are being produced for Pan American Airways, will be larger than the Model 307s, having a wing span of 152 ft., length of 109 ft., and an overall height of 28 ft.

Engineers in charge of the project state









*Patent Office design drawings and artists sketches showing outlines of two Boeing commercial transports for long-range operations*

that the new "super-Clipper" ships follow, as to type, the general lines of their predecessor Clipper ships. However, they are approximately twice the size of the Sikorsky Clippers and half again as large as the Martin flying boats. Also appearing well streamlined in shape, they will be powered with four 1500 hp double-row, 14-cylinder Wright Cyclone engines of a design recently announced by the Wright Aeronautical Corp. The Boeing flying boats will accommodate 72 passengers on day flights as well as a crew of 8, and at night will provide upper and lower berths for 40 passengers. In addition, there will be space for more than 5,000 lbs. of mail and express.

Also all-metal, the Model 314, however, is a high-wing full-cantilever monoplane. Sponsons or short hydrostabilizers will be provided for taxiing purposes and to provide lateral stability when the plane is at rest on the water.

For the first time on an American airplane, there will be two full flight decks—an elaborate upper deck for the flight crew and cargo and a main deck with luxurious passenger accommodations. Companionways through the wings will give access to engine nacelles during flight.

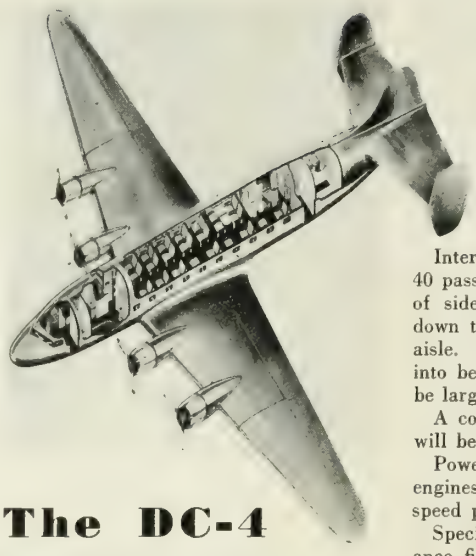
Forward on the upper deck is the flight bridge with posts for the chief pilot and five other flight officers. Behind the control rooms and within the wings are the main cargo compartments for mail and express; directly aft of these are sleeping and living quarters for the crew.

The main deck is connected with the upper deck by a circular stairway. In the nose is a compartment containing mooring apparatus and additional cargo space, the remainder of the deck being devoted to the passenger accommodations. In addition to the passenger cabins, there are a dining and lounge saloon in the center section, a private compartment in the rear, a galley in the forward section, lavatories and dressing rooms forward and aft. Beneath the passenger deck is a series of watertight compartments extending the length of the ship.

Soundproofed and provided with heating and ventilation systems, the new flying boats will be luxuriously furnished with all modern appointments.

Although performance figures have not been announced, it is understood the Model 314 flying boat will have a speed ranging up to 200 mph and a cruising range of almost 5,000 miles. About 5,000 gallons of fuel will be carried within the wings and sponsons.

Pan American Airways has ordered the stratosphere-type landplanes as well as the flying boats. Six of the standard-type landplane transports will be built for Transcontinental & Western Air which has an option on 17 more. First of the landplanes is scheduled to be ready for flight in the spring of 1938, and the first Boeing Clipper before the end of this year.



# The DC-4 DOUGLAS

● With completion of jigs recently, construction is now underway on the first four-engined Douglas transport, the DC-4. Representing an expenditure of $1,000,000 and the cooperation of the engineering staffs of major airlines, the plane will have accommodations for 40 passengers and a crew of 5, as well as refinements in interior accessories intended to offer the maximum in comfort and convenience.

It is anticipated that the first machine will take to the air for initial tests some time early this fall. The ship will embody the most modern devices for safety, including a retractable nose wheel. Known as the "level landing" gear, this landing gear system, in addition to its safety feature, is intended to enable passengers to sleep through landings.

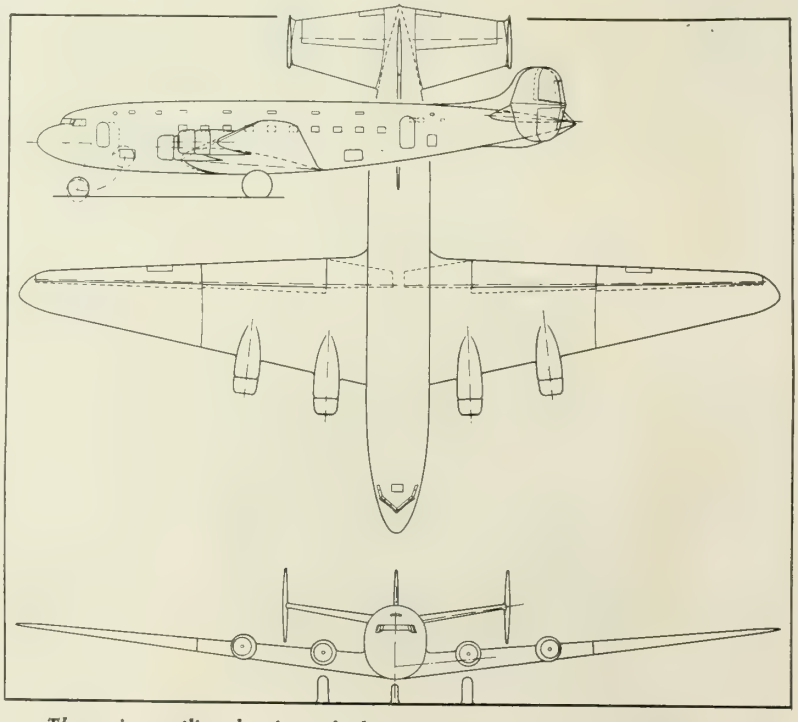
Interior of the DC-4 is so arranged that 40 passengers may be carried in two rows of side-by-side seats, extending 10 deep down the cabin and separated by a wide aisle. Seats will be readily convertible into berths of the pullman type, and will be larger than those used on trains.

A complete kitchen and cooking galley will be forward of the cabin.

Power will be supplied by four 1250 hp engines driving three-bladed constant speed propellers.

Specifications and estimated performance figures of the DC-4 follow:

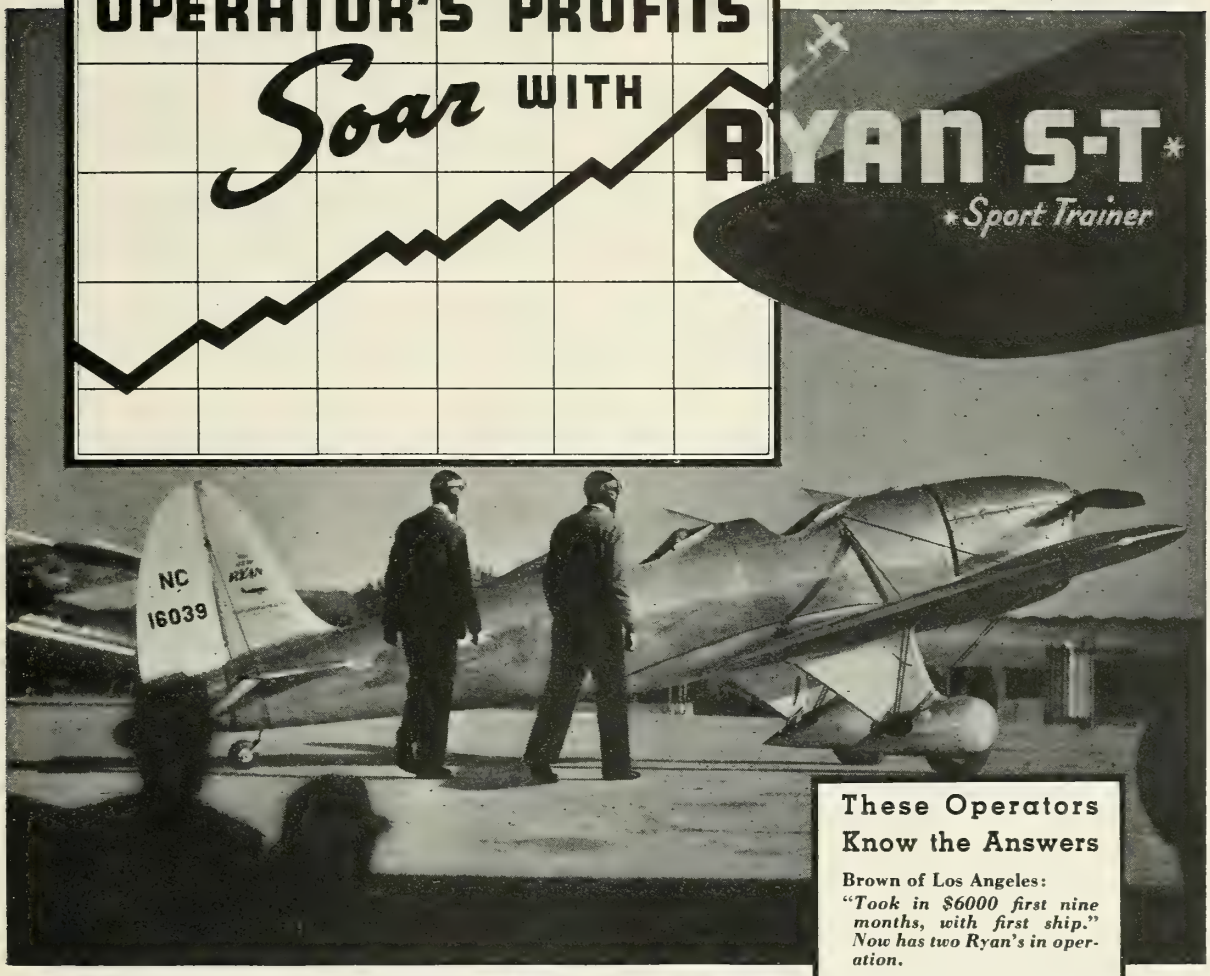
| | |
|---|---|
| Wing span | 138 feet 3 inches |
| Overall length | 97 feet 7 inches |
| Overall height | 24 feet 4 inches |
| Empty weight | 40,000 pounds |
| Useful load | 20,000 pounds |
| Gross weight | 60,000 pounds |
| Maximum speed | 237 miles per hour |
| Landing speed | 68.5 miles per hour |
| Absolute ceiling | 24,000 feet |
| Service ceiling | 22,900 feet |
| Two-engine ceiling | 7700 feet |
| Cruising range | 2200 miles |



*Three view outline drawings of the 40-passenger four-engined Douglas DC-4*

# OPERATOR'S PROFITS Soar WITH RYAN S-T*

*Sport Trainer




## These Operators Know the Answers

Brown of Los Angeles:
*"Took in $6000 first nine months, with first ship." Now has two Ryan's in operation.*

Stockert of South Bend:
*"190 hours and not a penny for maintenance. Soloed 47 students."*

Demorr of Philadelphia:
*"Never knew a ship could have such an appeal to students."*

Lyon of San Francisco:
*"Too busy with students to send details except to say business is beyond expectations."*

Extracts taken at random from a few of many letters from Ryan operators.

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Ryan

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# Digest of Technical Articles from Foreign Publications

## AERODYNAMICS

### Tests of Skis

*Wind Tunnel Tests of Aircraft Skis (Windkanalmessungen an Flugzeug-Schneekufen; M. Kohler, Gottingen: Luftwissen, Bd. 4, No. 21, Jan.,* 1937)

Outline drawings and complete account of experiments conducted at the Gottingen Aerodynamic Laboratory on six different types of skis tested in Gottingen Wind Tunnel. The reports are presented in the form of polars and tables. Test data include information on forces, moments, pitching and yawing. The data is fairly complete and provides a valuable reference for a subject on which information in general is rather meager.

### Wing-Nacelle

*Wing-Nacelle Interaction. S. M. Gorlin and V. P. Gorski; N. E. Joukowski's Central Aero-Hydrodynamical Inst.; Technic of the Air Fleet; No. 2, Feb.,* 1937

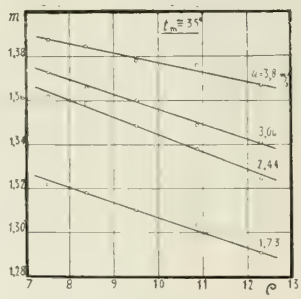
Despite numerous tests made in various laboratories, the wing-nacelle interaction supplies what seems to be, a never ending subject of research. Many of these misdirected efforts can be traced to confused interpretation of results and narrow experimental approach to the problem. The results of these new Russian tests seem to differ slightly with our own tests, the optimum location of the nacelle being indicated at 40% forward of the leading edge rather than 25% as seems to be the case in our tests. The comparison, however, is not apparent because of the international confusion in methods of calculating the propulsive efficiency, drag proper of the nacelle and in general, the method of interpreting the experimental data.

This paper is interesting, however, since it supplies additional facts which can be reworked for a more accurate comparison with other existing information.

### Wind-Tunnel Tests

*The Performance and Longitudinal Stability of a Single-Engined High Wing Monoplane; Experiments on a Quarter Scale Model with Airscrew Running. L. W. Bryant., A.R.C.Sc., D. H. Williams, B.Sc., and A. F. Brown, B.Sc. of the Aerodynamics Dept., N. P. L., Air Ministry (Gt. Britain): Aeronautical Research Comm. R & M* 1687. *May,* 1935

The present report deals mainly with experiments on a 1/25 scale model of the Puss Moth in the Duplex wind tunnel, a repetition, with some additions, of the work carried out on the 1/20 scale model of the Bristol Fighter and described in R & Ms 876 and 937.




*Values of the Polytropic's exponent as a function of piston speed and compression ratio for cooling water temperature of 35° C*

There are also included some measurements of lift, drag, and pitching moments of the 1/10 scale model in the 7 ft. tunnel. These cover a range of negative angles of incidence from 10° as well as the usual positive range up to about 20° incidence. The Puss Moth shows some longitudinal instability at high speed and when diving, due to a low position of the cg relative to the mean wing chord.

### Undercarriages

*A Comparison of the Drag of Trousered and Retractable Undercarriage. R. Jones, D.Sc., A. H. Bell and A. F. Brown, B.Sc. of the Aerodynamics Dept., N. P. L.; Air Ministry (Gt. Britain): Aeronautical Research Comm. R & M* 1691. *Feb.,* 1936

Experiments described in this report were conducted at the request of the Aeronautical Research Committee on models provided by deHavilland Aircraft Co. To obtain typical figures for the drag of a streamlined landing gear and to estimate the gain that would result if the gear were completely retracted, two nacelles were mounted on a standard airfoil, first with a fixed streamlined landing gear and secondly faired as they would be with a retractable gear. The difference of drag was thus obtained in the presence of a wing.

The experiments were conducted over a range of incidence in the Compressed Air Tunnel at values of R= 3 and 4 millions approximately.

Addition of the nacelles results in a decrease of maximum lift of about 7 to 10%, with a change of about 0.8° in the no lift angle. The drag of the wing, nacelles and streamlined landing gear is 65% greater than that of wing and nacelles, at a high Reynolds number.

## ENGINES

*Experimental Research of Compression of the Two-Cycle Diesel Motor (Ricerca Sperimentale sulla Fase di Compressione in un Motore Diesel a due Tempi: Dott. Ing. Prof. Giusseppe Manzella; l'Energia Termica, No. 2, Feb.,* 1937)

After brief theoretical analysis, the paper gives an account of experiments conducted to determine the polytropic of compression ratio, rpm. and cooling water temperature. The values obtained differ considerably with those normally assumed in calculations.

## GENERAL

*Contributions to Aeronautics (Beitrage zur Flugtechnik Ing. Richard Katzmayr, Wien; Verlag von Julius Springer) Price RM* 5.40

This pamphlet commemorates the 25th anniversary of the Aerodynamical Laboratory of the *Technische Hochschule in Wien* (Vienna's Technical Institute). The contributors include R. Katzmayr, professor at the Institute and director of the laboratory, who edited the pamphlet; L. Kirste, W. B. Klemperer, F. Magyar, E. Melan, R. V. Mises, A. Proll, and J. Ratzersdorfer.

Subjects covered include description of the laboratory, the circulation theory, stability phugoids, description of a 600 hp. airplane of 1916, flapping flight, space framework, compression strength of struts of variable cross section, and introduction into the calculations of a box beam.

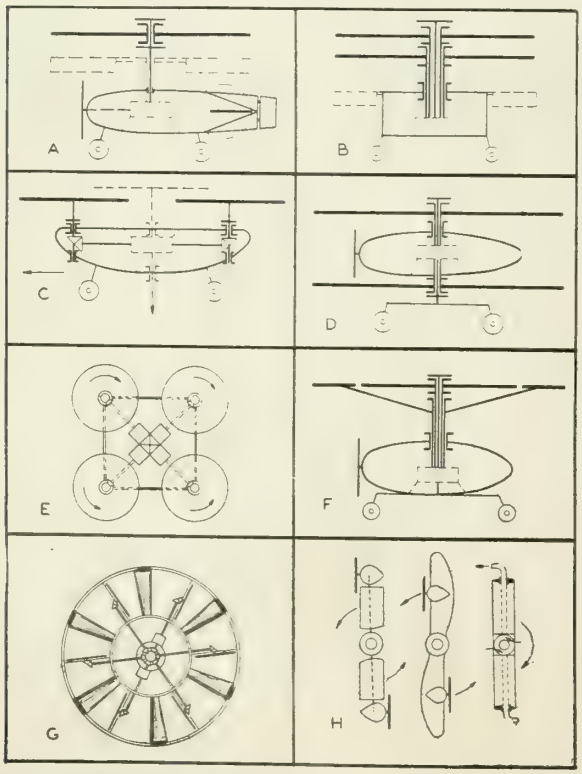
The pamphlet contains 43 pages and 19 illustrations. Articles are written with the usual clarity of the able contributors whose names are well-known to students of the subject.

## HELICOPTERS

*The Question of the Helicopter (Fragen des Drehfluglers; Th. Mohring: Luftwissen, Bd. 4 No. 21, Jan.,* 1937)

Semipopular review of the problem of the helicopter. The article first reviews the general problem of propeller action in combined motion and power required. Then it analyzes various factors affecting the functioning of the lifting propeller such as the number of blades, blade width and speed of rotation. Various mechanical combinations are proposed and reviewed, and the problem of stability is analyzed.

(*Continued on following page*)




*Basic arrangements of helicopter lifting screws (from "Luftwissen")*



# BALANCE

Every blade of a Hamilton Standard propeller is carefully checked for balance against a master weight before it goes to the assembly line. Each blade must be in perfect balance, not only for every position of rotation, but also throughout its entire range of pitch angles. The precision with which this equilibrium is achieved assures interchangeability of blades in the field and dynamic balance in operation.

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EAST HARTFORD
CONNECTICUT
DIVISION OF
UNITED AIRCRAFT CORPORATION
PROPELLERS

HAMILTON STANDARD PROPELLERS
EAST HARTFORD, CONNECTICUT
DIVISION OF UNITED AIRCRAFT CORPORATION

(*Continued from preceding page*)

## AERODYNAMICS

### Airflow Studies

*Use of Smoke for Studies of Airflow Around Obstacles (Methode des Fillets de Fumee pour l'Etude de l'Ecoulment de l'Air autour des Obstacles; Jacques Valensi; l'Aeronautique, No.* 213, *Feb.,* 1937)

Description of the mechanical arrangement used by the author for generating the smoke, its emission and control and the apparatus used for observations and photography. It gives the application of the method for the studies of airflow around a propeller, wing and complete airplane model.

The author further indicates how the results can be used to obtain the circulation about any section along the propeller blade. Use of the method in tests on complete models is claimed to aid considerably in interpreting the stability characteristics of the model.

### Trailing Edge Flaps

*Trailing Edge Flaps in Relation to Take-off and Landing of Landplanes. S. B. Gates, M.A. Communicated by the Director of Scientific Research, Air Ministry (Gt. Britain): Aeronautical Research Comm. R & M* 1707. *Aug.,* 1937

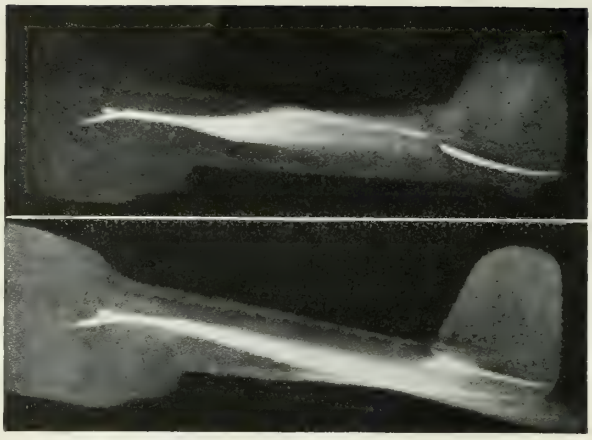
A survey of the potentialities of trailing edge flaps as aids to take-off and landing with high loads is given in these notes. The model evidence on the lift and drag characteristics of trailing edge flaps of several types—plain, split, slotted and Fowler—is analyzed and given in a form convenient for quick application in design. It is used in an attempt to decide which types of flap, and in what circumstances, can be used to assist take-off.

Diagrams are constructed from which rough estimates can be made of the size and type of flap necessary to land an aircraft of given loading and unflapped characteristics in a specified distance in given ground conditions. The problem of the highly loaded airplane has been considered, loading up to 30 lbs./ft.$^2$ being included in the calculation.

### Cutaway in Flaps

*The Effect of Central Cutaway in Split Flaps on the Trim of a Low Wing Monoplane. D. W. Bottle, B.Sc., A.C.G.I., C. Callen and K. W. Kirkby. Communicated by the Director of Scientific Research, Air Ministry (Gt. Britain): Aeronautical Research Comm. R & M* 1701. *Sept.,* 1935

This investigation is made because scale tests on a number of airplanes with split flaps indicated that there may be a considerable change in trim when the flaps are brought into operation. The investigation has been made on 15% Schrenk flap at 60°. The change in position of the center of pressure, the change in downwash at the tail, and the change in tail setting to trim, due to bringing the flaps into operation, have been measured for flaps of different amounts of central cutaway. Tests were made with tailplane in two positions, and lift and drag curves were also obtained.



*Airflow with propeller stopped (above) and rotating (below)*

### Compressed Air Tunnel

*Experiments On A Heinkel He-70 Aeroplane In the Compressed Air Tunnel; R. Jones, D.Sc., and E. Smith, B.Sc. of the Aerodynamics Department, N.P.L.; Air Ministry (Great Britain), Aeronautical Research Committee; R. and M. No.* 1709, *February* 1936

A Heinkel He-70 high-speed mailplane was tested by Vickers Aviation in their wind tunnel at Waybridge and at R.A.E. and the results are found to lay on a curve which appears to pass through the point corresponding to the results of D.V.L. tests on the full scale machine. This report presents the results of tests conducted in the compressed air tunnel. The C.A.T. values agree well with the full scale value. Drag coefficient (on a wetted area basis) follows the skin friction curve closely up to Reynolds number of 1.5 millions but after that becomes appreciably greater.

### Oscillations

*Oscillations of Elastic Blades and Wings In An Airstream; W. J. Duncan, D.Sc., A.M.I. Mech., E., F.R.Ae.S., Wakefield Lecturer On Aeronautics, University College, Hull, A. R. Collar, B.A., B.Sc., Of The Aerodynamics Department, N.P.L. and H. M. Lyon, M.A., A.F.R.Ae.S. Air Ministry (Great Britain) Aeronautical Research Committee and No.* 1716, *January* 1936.

This report develops a method for a theoretical treatment of the oscillations of blades and wings in an air current, uses this method to check the correctness of the current "semi-rigid" theory, and makes detailed applications to a class of solid tapered blades.

Part 1 gives a general account of the proposed method. Part 2 contains a description of a method for determining the critical condition of a system having many degrees of freedom, while Part 3 is concerned with the detailed applications and comparisons with the "semi-rigid" theory. An exact solution for the oscillations of a uniform blade without flexural stiffness is given in the appendix.

### Turbulence

*Note of the Structure of Turbulence in a Natural Wind; Containing also a Description of a Sensitive Pressure Gauge. A. Graham, H.Sc., D.I.C. of the Royal Aircraft Establishment; Air Ministry (Gt. Britain): Aeronautical Research Comm. R & M* 1704. *Jan.,* 1936

To extend knowledge of the structure of a natural wind the pressure fluctuations from a Dines Head, mounted on the top of the wind tower at the National Physical Laboratory, were analyzed by a photo-intergrating method to determine the frequency distribution of gust velocity.

These experiments are described in this report together with a description of a sensitive diaphragm pressure gauge, of general utility, which was developed for the experiments. The structure of winds prevailing at the time of the experiments having mean velocities between 10 and 15 ft./sec. was analyzed and it was found that the frequency distribution of gust velocity follows closely the normal error law.

### FLUTTER

*Proper Frequencies of Vibrations of the Wing and Tail Surfaces of Aircraft. I. B. Ananiev; N. E. Joukowski's Central Aero-Hydrodynamical Inst.; Technic of the Air Fleet, No.* 1, *Jan.,* 1937

The paper is intended to furnish the designer a comprehensive method for determining the frequencies of vibrations of the wing and tail surfaces of a new design. Scientific accuracy is somewhat sacrificed for expediency, the method being primarily intended as an engineering tool.

To determine the frequencies of wings without taper, use is made of the method normally employed in calculating frequencies of a cantilever beam of uniform rigidity. The differential equations used include the general case of a wing with a concentrated mass.

Calculations of the vibrations of tail surfaces takes cognizance of the elastic characteristics of supports, and an extension is given for the case of trapesoidal wings and combined vibrations.

### ENGINES

*Power Plants for High Speeds. P. I. Orloff; Technic of the Air Fleet,* 1, *Jan.,* 1937

The rapid increase in high and cruising speeds of modern military and commercial aircraft sets a premium on every factor affecting the design. Small gains or losses meant little in the cruder airplanes of the recent past, but, with the increase in speeds, the consequent power demand is such that all efforts must be directed to decrease resistance and recover power losses inherent in the present type of power plant installation.

The author points out that Howard Hughes uses 60% of the power of his engine to drive it through the air and wastes 50% of the potential power of the fuel in the form of exhaust. Engineering significance of these figures is appalling and studies are under way to recover heat losses and minimize resistance of the engine proper.

This article analyzes the losses which are typical of the standard power plant installation and treats the subject of cooling and possible power recovery by various thermodynamic-mechanical means.

(*Continued on following page*)




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Department S-18, Airport, Oakland, California.
Please send BOEING SCHOOL BULLETIN without obligation to me. (I'm interested in courses checked):

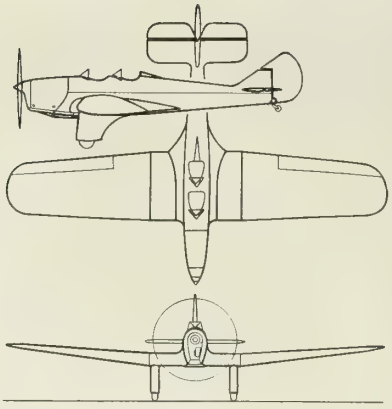
☐ Airline Pilot and Operations ☐ Airline Operations ☐ Air Transport Engineering (*2 years pre-engineering required*)
☐ Transport (*or*) L. C. Pilot ☐ Airline Mechanic ☐ Practical Aeronautical Engineering (*2 years pre-engineering required*)
☐ Private (*or*) Amateur Pilot ☐ Aircraft Sheet Metal
☐ Non-scheduled Inst. Rating ☐ Airline Technician (*for engineering graduates only*)
☐ Airline Dispatching & Meteorology (*for engineering graduates only*) ☐ Special Airline Pilot (*for Transpt. Pilots with 400 hrs.*) ☐ Home Study Courses (*for those in the industry*)

*Name*_____ *Age*_____

*Address*_____ *Years in High School*_____

*City*_____ *State*_____ *Years in College*_____





# Miles "Hawk" Primary Trainer

## as used by Royal Air Force cadets

● Royal Air Force cadets are now receiving their primary training in the Miles *Hawk* Trainer, a large number of which have been ordered from Phillips & Powis Aircraft, Ltd., whose chief engineer, F. G. Miles, is responsible for the design.

A low wing cantilever monoplane, the *Hawk* has been engineered to possess the advanced characteristics in speed and handling demanded by present-day requirements. It is of all-wood construction and provided with ample inspection covers to facilitate maintenance and inspection.

The P & P 4 airfoil section of the cantilever wing is made up of two spars with a plywood covering to take drag and torsional stresses. Outer panels are constructed with girder type ribs, while the center section (which is built integral with the fuselage) has ring type box ribs. Hydraulically-operated split trailing edge flaps are provided to give a steep angle of approach and low landing speed with positive speed up to and beyond the stall. Wings can be folded by lifting the flaps and withdrawing two horizontal bolts in the front spars.

Plywood and spruce have been used in the fuselage which is of conventional construction. Each cockpit is provided with a parachute seat, three-piece safety glass windshield and a complete set of instruments, as well as individual controls. The rear cockpit also is provided with a 5.5 cu. ft. baggage compartment, located aft of the seat. Instruments provided in each cockpit include an airspeed indicator, altimeter, tachometer, oil pressure gauge, compass, turn and bank indicator and rate of climb indicator. The front cockpit contains, in addition, a master engine switch.

Tail unit is full cantilever, all surfaces having a wooden structure, fabric covered. The fixed landing gear is the individual leg type, equipped with Bendix brakes, Palmer low-pressure tires, airdraulic shock absorbers and detachable metal leg fairings.

Power is supplied by a 130 hp. deHavilland *Gipsy Major* four cylinder inverted in-line engine mounted on a welded steel tube structure and equipped with a wood propeller. Tankage is provided for 32 gals. of fuel carried in the wing roots, and for 2.5 gals. of oil, carried in the leading edge of the port wing next to the fuselage.

Specifications and performances:

| | (*English*) | (*Metric*) |
|---|---|---|
| Wing span | 34 ft. | 10.36 m. |
| Overall length | 24 ft. | 7.31 m. |
| Overall height | 7 ft. | 2.13 m. |
| Wing area | 176 ft.$^2$ | 16.35 m.$^2$ |
| Empty weight | 1240 lbs. | 564 kg. |
| Useful load | 585 lbs. | 265 kg. |
| Gross weight | 1825 lbs. | 829 kg. |
| Maximum speed | 145 mph | 233 kph |
| Cruising speed | 125 mph | 201 kph |
| Landing speed | 45 mph | 72 kph |
| Climb per min. | 1200 ft. | 364 m. |
| Service ceiling | 18.000 ft. | 5480 m. |
| Cruising range | 400 mi. | 643 km. |

## Digest of Foreign Technical Articles

(*Continued from preceding page*)

### MATHEMATICS

*A Successive Approximation Process for Solving Simultaneous Linear Equations. J. Morris, B. A., A.F.R.Ae.S. Communicated by the Director of Scientific Research, Air Ministry (Gt. Britain): Aeronautical Research Comm. R & M* 1711, *Nov.*, 1935

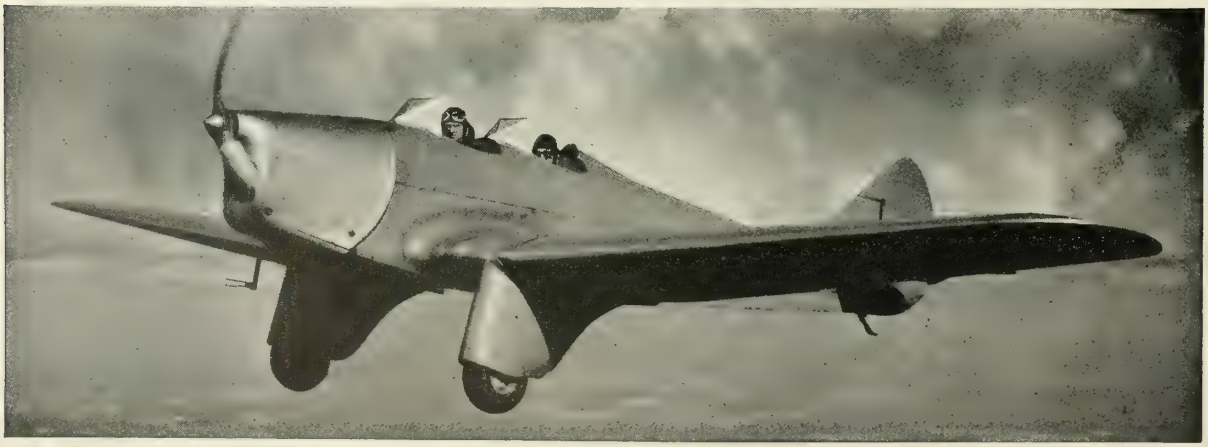
Simultaneous linear equations of three or more variables are commonly troublesome to solve numerically. This report describes a successive approximation method of solution which has been developed as a result of work on the simultaneous equations arising in structural problems.

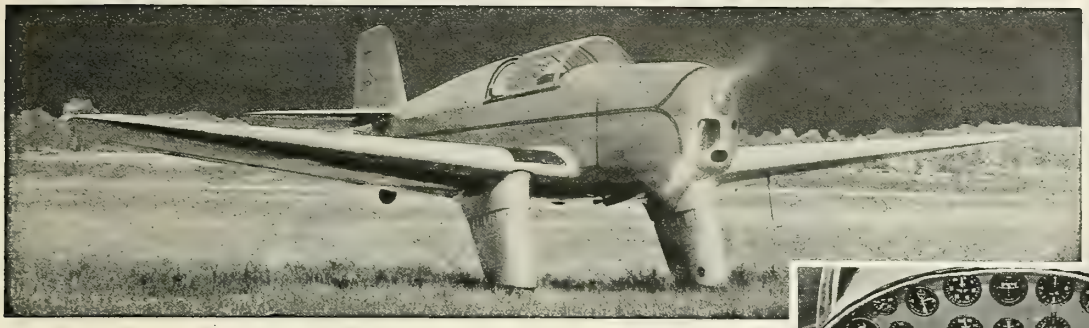
The process is essentially a tabular one based on the iteration principle. A detailed description of the procedure is given by reference to full examples and the condition governing the convergence of the process are discussed. Certain special devices for the treatment of difficult cases are also mentioned.

### STRUCTURES

*Brief Comparison of Materials used in Aircraft Construction from Viewpoint of Weight and Size (Breve Confronto dei Materiali Usati nelle Costruzioni Aeronautiche dal Punto di Vista del Peso e dell' Ingombro: Dott. Ing. Vittorio Calderini; Auto Moto Avio, No.* 5, 15 *Mar.*, 1937)

Relative structural characteristics of wood, duralumin and steel are compared in an abstract form. The subject is not new, but the approach is somewhat different from previous analyses. The conclusions are well-known to specialists in the industry but it is well to have it repeated that not much can be improved on wood in bending. This consideration is of interest technically and economically from the viewpoint of commercial application.





# The JONES S-125

## America's Modern Plane

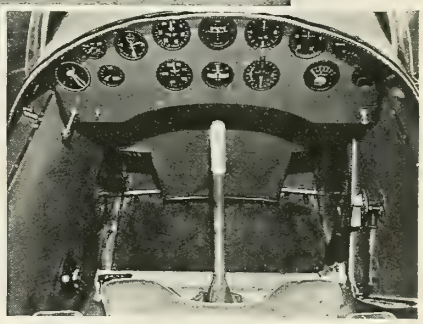
**for Sport or Commercial Flying**

A Low-Wing, Two-Place Model with
the Comfort and Performance of an Airliner.

Wing Span—31 feet. Wing Area—140.5 square feet.

Standard Power Units: 125 H.P. or 150 H.P. Menasco C4 or C4S Motor.
Maximum Speed—151 M.P.H. Cruising Speed—136 M.P.H.

*Write for Illustrated Literature*



VIEW of Control Cockpit; all Control Units conveniently placed. Adequate additional space for installing blind flying instruments and Radio Control. Features include a parking brake that locks both wheels and rudder for those unattended nights in the open. Roomy luggage compartment and comfortable lounge-chair arm rests containing spacious utility pockets.

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## AIRCRAFT SEAMLESS STEEL TUBING

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Michigan Seamless Tube Company products comply with individual customer's requirements as well as standard requirements of the S.A.E., A.S.M.E., A.S.T.M., and the U. S. Army and Navy Air Corps.

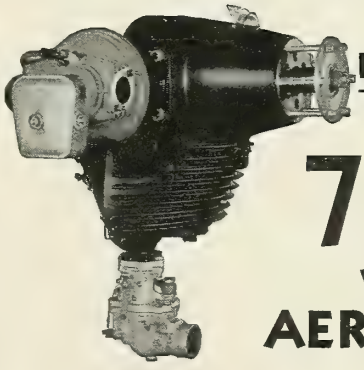
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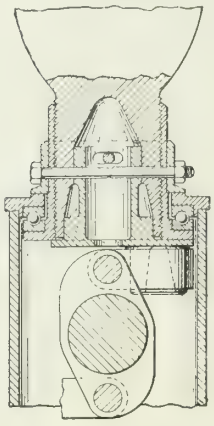
## THE GOVRO-NELSON COMPANY

1931 Antoinette Detroit, Mich.

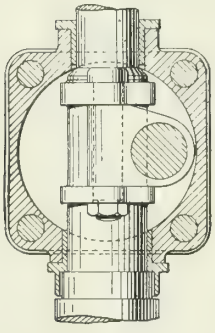
# RECENT PATENTS

● The following recent patents of interest to readers of AERO DIGEST were compiled from the Official Gazette of the United States Patent Office:

Screw propeller, Francis Samuel



2,075,682



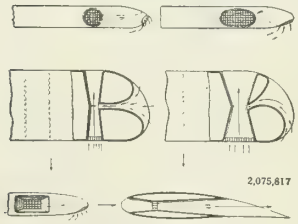
Welman, Bexley Heath, England, assignor to C. L. W. Aviation Co., Ltd. (2,075,682)

System for landing aircraft. Ernest Kramar, Berlin-Tempelhof, Germany, assignor to C. Lorenz Aktiengesellscheft. (2,072,267)

Heat treating furnace and method of heat treating. Lewis Newell Davis, Santa Monica, Calif., assignor to Douglas Aircraft Co., Inc. (2,075,929)

Fuel tank for aircraft. Carl de Ganahl, Greenlawn, N. Y., assignor to Fleetwings, Inc. (2,075,977)

Wing vortex reducer. Arthur W.



2,075,817

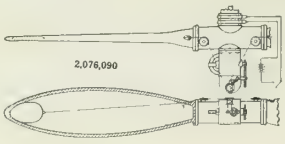
Loerke, Dayton, Ohio. (2,075,817)

Screw (self-tapping). Ernest Payne, Chicago, Ill., assignor to Central Screw Co. (2,076,041)

Aircraft wing structure. Stanley Asbury, St. Paul, Minn. (2,076,059)

Control mechanism for airplanes. Boleslaw Malinowski, Buffalo, N. Y. (2,076,088)

Propeller. George Francis



2,076,090

Myers,, New York, N. Y. (2,076,090)

Distortion check for welding apparatus. Laurence C. Powell, Portsmouth, Va. (2,076,207)

Flap operating means. Arthur

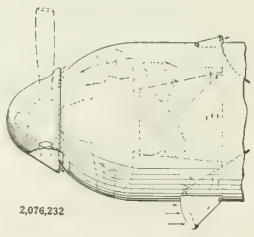


2,076,150

L. Klein, Los Angeles, Calif., assignor to the Northrop Corp. (2,076,150)

Engine cowling, and engine cooling and cowling. Roland Chilton, Ridgewood, N. J., assignor, by mesne assignments, to the Reed Propeller Co. (2,076,224 and 2,076,225)

Engine cowling and cooling.



2,076,232

Willard B. Goodman and Wesley L. Losson, Passaic, N. J., assignors to Wright Aeronautical Corp. (2,076,232)

Mount for wing guns. Robert A. Swalm and Carl R. O. P. Heintze, Kenmore, N. Y., assignors, by mesne assignments, to Curtiss-Wright Corp. (2,076,256)

Anti-vibration vane. Theodore P. Wright, Buffalo, N. Y., assignor, by mesne assignments, to Curtiss-Wright Corp. (2,076,259)

Aluminum alloy and article made therefrom. Hans Steudel and Heinz Wiechell, Dessau, Germany, assignors, by mesne assignments, to Junkers Flugzeug-und-Motorenwerke Aktiengesellschaft. (2,076,281)

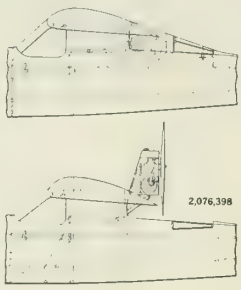
Displaceable rudder for aircraft. Jerzy Teisseyre, Warsaw, and August Zdaniewski, Biala Podlaska, Poland. (2,076,283)

Aircraft. Yürgen Baron Silberg von Stackelberg, Baltimore, Md., assignor of one-half to Margaret G. Doll. (2,076,327)

Exhaust gas analyzer for automotive vehicles. Louis S. Wait, Seattle, Wash., assignor to Boeing Aircraft Co. (2,077,538)

Airplane. Robert V. Morse, New York, N. Y. (2,077,708)

Aircraft. John Valentine Carden,



2,076,398

Camberley, England. (2,076,398)

Aircraft. Abraham S. Fink, Gloversville, N. Y., assignor to Aero Improvements, Inc. (2,077,471)

Wing surface. Herbert Luther Adams, Washington, D. C. (2,077,732)

Aerial mail catcher. John Mores, Millsboro, Pa. (2,076,476)

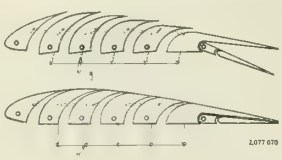
Automatic air motor governor. Russel Swanson, Cleghorn, Iowa, assignor of one-third to L. H. Cutler and one-third to Oscar E. Johnson. (2,076,520)

Free cutting alloys. Louis W. Kempf and Walter A. Dean, Cleveland, O., assignors to Aluminum Co. of America. (2,076,567 to 2,076,580)

Cylinder of internal combustion engines. Harry Ralph Ricardo, London, England. (2,076,593)

Fuel injecting device for internal combustion engines. René Jacques Henri Planiol, Paris, France, assignor of one-half to Joseph Schidlovsky. (2,077,259)

Airplane. William K. Rose,



2,077,070

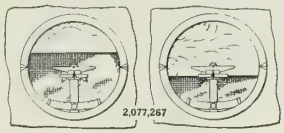
New York, N. Y. (2,077,070 to 2,077,072)

Automatic landing gear. Arthur George Mirel, New York, N. Y. (2,077,178)

Airplane landing field using directional radio beams. Ernst F. W. Alexanderson, Schenectady, N. Y., and John Hays Hammond, Jr., Gloucester, Mass., assignors to General Electric Co. (2,077,196)

Engine starting mechanism. Arthur E. Raabe, Summit, N. J., assignor to Eclipse Aviation Corp. (2,077,263)

Flight indicator for aircraft.



2,077,267

Elmer J. Rogers, Jr., U. S. Army, Honolulu, Hawaii. (2,077,267)

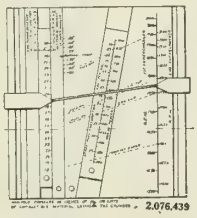
Multiplate transparency. George W. Batchell, Toledo, Ohio. (2,077,305)

Engine starting mechanism. Raymond P. Lansing, Montclair, N. J., assignor to Eclipse Aviation Corp. (2,077,333)

Navigating instrument. Joseph C. Clark, Merchantville, N. J., assignor of one-half to The Ludington Corp., and one-half to N. S. Ludington Securities Co. (2,077,398)

Method for the automatic control of the power output of aircraft engines. Emil Shimanek, Budapest, Hungary, assignor to Societe du Carburateur Stratos. (2,077,775)

Calculator. John W. Young,



2,076,439

Dundalk, Md. (2,076,439)

Reciprocating winged device for airplanes. Martin Jelalian, New York, N. Y. (2,077,798)

Airplane wing construction. Donald L. Sutton, Pittsburgh, Pa. (2,077,859)

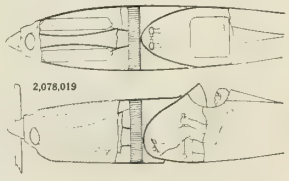
Flying machine. Robert M. Thomson, Indianapolis, Ind. (2,077,910)

Building construction (aviation shed). Eugène Germain Paul Mopin, Paris, France. (2,077,950)

Carburetor for internal combustion engines. Ignaz Schorsch, Prague, Czechoslovakia. (2,078,029)

Ballast water recovery for airships. Wilhelm O. L. Fischer, Akron, Ohio, assignor to Goodyear-Zeppelin Corp. (2,078,532)

Aircraft. Henri Augustin Rabatel, Paris, France. (2,078,019)

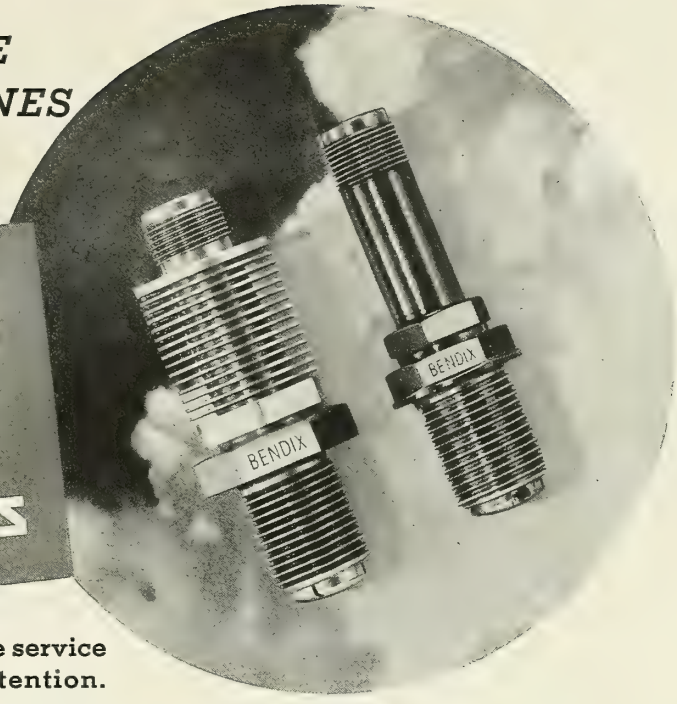


2,078,019

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**BENDIX** *Aircraft* **SPARK PLUGS**




**afford maximum reliable service life with minimum attention.**

SCINTILLA MAGNETO CO., INC.
*(Subsidiary of Bendix Aviation Corporation)*
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**Join the Convenient Cabana Colony**
*AT*
**Chalfonte-Haddon Hall**

STRETCH out on our own stretch of beach before these convenient boardwalk hotels. Smart cabanas rim the sandy arena. At the large club cabana congenial young folks loll and read, play cards, or volley ball, or sun between dips to the strains of radio music. Lunch in your suit, if you like, at our Surf Club Grill.

Parents take note: the youngsters have their cabana too—Sandy Cove, in charge of trained play supervisors.

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**ATLANTIC CITY**




**loading anti-friction thrust bearing**

THESE LAMINUM SHIMS have been providing quick, precision adjustments in Wright Whirlwind motors for 12 years . . . QUICK because the layers of brass p-e-e-l so easily from the solid laminated shim, saving filing or machining; ACCURATE because each lamination provides .002" adjustment.

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# EQUIPMENT and METHODS

## BREEZE EXHAUST GAS ANALYZER

Rapid and accurate determination of the mixture ratio delivered by a carburetor to the engine during flight is obtained by use of the Breeze exhaust gas analyzer (fuel-air ratio indicator).

Breeze Corporation instrument utilizes the thermal conductivity of the exhaust gas produced by combustion of the fuel-air mixture. The apparatus consists of an analyzing unit comprising 4 thermal conductivity cells arranged in the form of a wheatstone bridge. Two of the cells contain air and two exhaust gas, allowing a comparison of thermal conductivity of exhaust gas and air under all conditions. Using a battery for current source, and placing a meter across the bridge, direct indication of the fuel-air ratio is obtained. The fuel-air ratio meter can be mounted either on the control box or on the instrument panel.

Assemblies are equipped with Breeze multiple circuit electrical connectors, and control boxes have a universal mounting bracket, permitting mounting to various parts of the aircraft structure and adjustment to any angle. Five different types of installations are available, including two for single engined planes and three for twin-engined craft.

## AIRPORT LIGHTING CONTROL PANEL

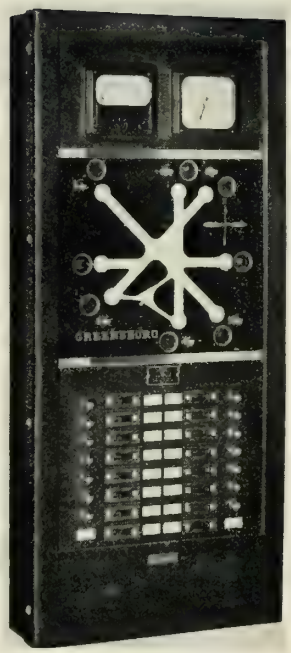
Centralized and positive control of the circuits to the lighting equipment of an airport is provided in a new control panel built by Westinghouse Electric & Manufacturing Company.

To meet the control requirements of the Greensboro-High Point (N.C.) Airport, one of these panels was installed, together with a complete and modern lighting system. The panel is a surface mounting, open-face type assembled in a steel cabinet, with a removable front giving access to the wiring terminals.

The upper section consists of a Micarta plate with flush-mounted instruments indicating wind velocity and direction, and operated electrically by an anemometer and wind vane assembly mounted on the roof of the administration building. Accurate information is thus provided at all times, either for the operator's use in selecting the proper group of field floodlights or for transmittal by radio to aircraft. The instruments eliminate the necessity of observing the usual outside wind indicators such as cones or tees and estimating the velocity and direction.

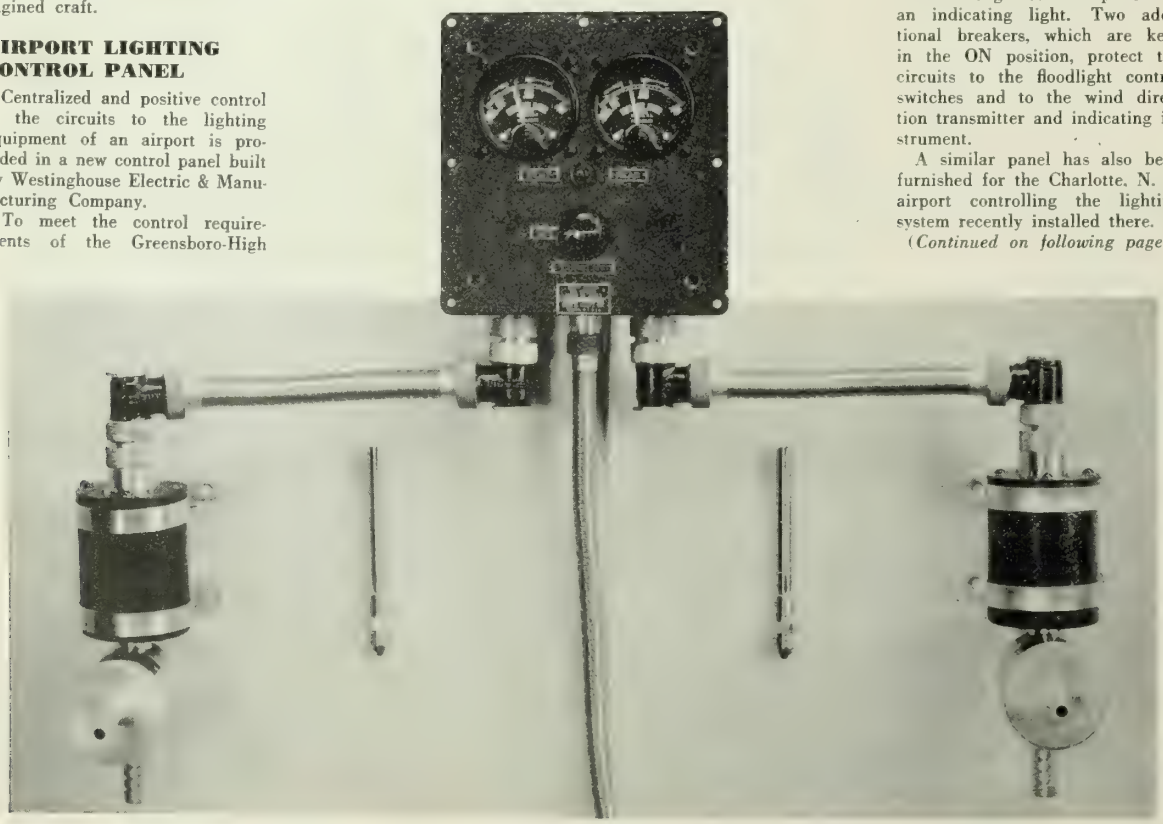
Center section of the panel contains the control for the field floodlighting, consisting of a Micarta plate on which a miniature colored plan of the field runways is inlaid. A switch is provided at each end of each runway for the remote control of the group of floodlights required for that particular direction of landing. Indicating lights are located on the field plan at the points corresponding to the actual positions of the floodlight groups on the airport. The airport name and the meridian marker are also inlaid in color on the plan.

Control for the other airport lighting circuits is grouped in the lower section of the panel, consisting of 14 single-pole, 15-ampere *Nofuze* circuit breakers operating both direct and remote-control circuits. Each breaker is provided with an engraved nameplate and an indicating light. Two additional breakers, which are kept in the ON position, protect the circuits to the floodlight control switches and to the wind direction transmitter and indicating instrument.



A similar panel has also been furnished for the Charlotte, N. C. airport controlling the lighting system recently installed there.

(*Continued on following page*)



*Twin-engine installation of Breeze exhaust gas analyzer with fuel-air ratio meters in control box*

# LOW in OPERATING COST

. . . that's the new Porterfield **"ZEPHYR"**



**The ZEPHYR has 2 seats, with dual controls, and is powered by a sturdy, long-life, 40 h. p. Continental engine. Top speed of ship is 85 m. p. h., cruising speed is 75 and landing speed 30. Cruising range is 250 miles and gas consumption 2¾ gallons per hour. Equipment includes airspeed indicator, altimeter, oil temperature gauge, oil pressure gauge, primer, tachometer, dual controls, stabilizer control adjustable in flight, fabric upholstered cabin, Spanish-leather seat backs and cushions, parachute type seats, roller bearing wheels, fire extinguisher, two safety belts. Approved for brakes. Standard colors: Porterfield Vermilion trimmed in Bonnett Blue. Price: $1495 F. A. F.**

THIS sturdy, low-priced ship develops over 27 miles to the gallon of gasoline, and uses very little oil. This means that both students and private owners can fly to their hearts' content at exceptionally low operating cost.

Get complete information on this fine performing, smart appearing ship—which you can buy at a remarkably low price and on very easy terms. Write TODAY for our new FREE illustrated folder—which also tells you about the outstanding Model 70 and Model 90.

*Desirable distributorships available in several valuable territories*

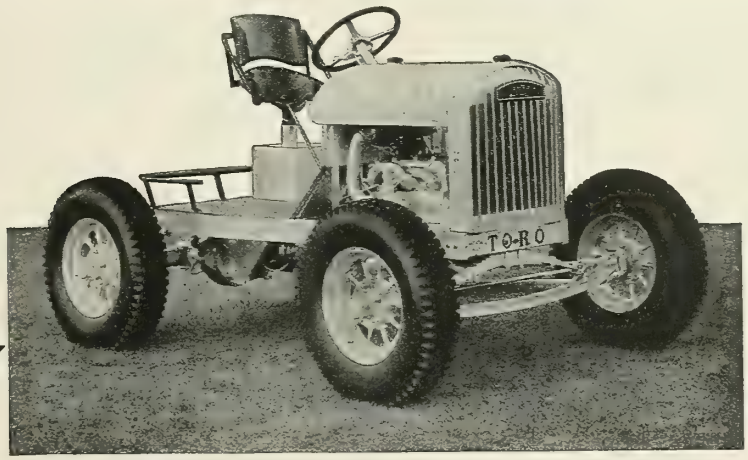
## The PORTERFIELD AIRCRAFT CORPORATION

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---

71 Inch Wheelbase

**FAST**




Turning Radius 6¾ Feet

**POWERFUL**

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**TORO MANUFACTURING CORPORATION**

**3042 SNELLING AVENUE MINNEAPOLIS, MINNESOTA**

*(Continued from preceding page)*

## SUNDSTRAND MILLING MACHINE

Model 3-C *Rigidmil,* a product of Sundstrand Machine Tool Co., is a milling machine, which on aluminum alloy propellers, mills the leading and trailing edges to shape. Holding one unit at a time, the machine has an output estimated at 17-28 per hour, working at 85% capacity.

Featuring increased production and more accurate finish than obtained by the hand method which it replaces in production, the 3-C feeds 88″/min. into two 5″ diameter cutters.

Previous to milling the edges, the hub is turned complete and a locating center is machined in the tip of the blade. The fixture is designed for varying lengths and pitches of the propeller blade, with the headstock unit mounted at the left hand end of the table and the tailstock at the right hand end.

A removable profile cam, located behind the work and bolted to both headstock and tailstock member, is arranged so as to spread the heads apart. A pitch cam is mounted to the front of the saddle to generate varying pitches of the blades, and swinging locators are provided to position the work before clamping. Rollers, mounted on the cutter arbors, come in contact with the profile cam which is so arranged that at the beginning and end of cut, the two independent heads are spread apart to facilitate loading and unloading the part.

The work is set in a universal chuck of the headstock, the tailstock being moved to position the work endwise. The blade is then positioned by the swinging locators, the chuck clamped and the tailstock locked in position. The locators are then moved back into the rest position after which the operator engages the table feed, the table moving from left to right. When the cut is finished, the fixture is unloaded, the operator engages the clutch to return the table to the starting position, and the cycle is repeated.

## METAL CLEANING COMPOUND

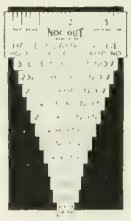
An all-purpose cleaner, formulated to take care of all general cleaning operations in the average plant has been developed by MacDermid, Inc. Known as *Metex,* Grade R, this compound employs modern and most efficient types of wetting and penetrating agents, chemically compounded with alkali bases to secure a product in which all constituents are equally balanced.

The composition incorporates a special buffer agent which increases the life of the cleaning bath before replenishments are necessary. This material causes the alkali to be split off progressively instead of releasing the energizing salts at once.

This compound, its manufacturers claim, possesses the qualities needed by the average plant for the average cleaning job. It is efficient when used for both soak and electro cleaning and it may be used for cleaning a variety of base metals.

## HOSE CLAMP GAUGES

Meeting demands for a method of determining the correct hose clamp size quickly and conveniently. Wittek Mfg. Co., Chicago, manufacturers of *Noc-Out* hose clamps have developed a hand gauge, made of a heavy composition material, and arranged with a series of steps on which the hose inside diameter and clamp size is clearly marked. To find the correct clamp size, the gauge is inserted into the end of




hose and the widest step over which the hose will pass determines the correct hose diameter and the correct size clamp to use. Wittek will send this gauge, at no cost, to any customer writing them direct.

## ENGLE STREAMLINE EXHAUST RING

Engle Aircraft Specialties have developed and tested a new type, low-cost exhaust ring which eliminates slip joints and flexible connections. Known as the Engle Streamline Exhaust ring, it features simple construction, easy installation, a compact and neat appearance, as well as an ability to enhance cooling of exhaust rings. It can be used either with a speed ring or an NACA cowl.



Elimination of the slip joint has not only effected a saving in weight and wear, but has also speeded production. In this design, a flexible system has been adapted to absorb engine vibration.

Quietness, without muffler, has been accomplished by the streamlined shape which breaks the regular forms of sound waves, and, with a large surface exposed to the airflow, ring and exhaust gases are cooler than is ordinarily the case. This allows a smaller outlet area with further saving in weight and space.

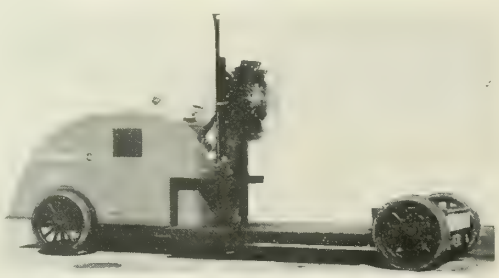
Design simplicity is achieved principally by the use of the engine diameter for the exhaust ring which clears all cowlings and other obstructions.

## ENGINE TEST STAND

Designed by Northwest Air Service to accommodate any aircraft engine, the new engine test stand shown in the accompanying illustration is an efficient unit which requires about 20 minutes for an installation.

As used by Northwest Air Service, the engine is first overhauled and then assembled on an engine plate in the engine shop. After the assembly, the engine, plate and all, is placed on the engine stand which is mounted in rubber to reduce strains and stress. The cabin contains all engine instruments necessary for run-in, a desk and a steering wheel and brake. The unit is moved by the power drive of the aircraft engine only and does not contain auxiliary power.

*Portable engine testing stand as used by Northwest Air Service of Seattle*



## DOUBLE FELT-SEAL FAFNIR BEARINGS

Additions to the line of bearings designed primarily for the aeronautical field (but currently used also by other industries) are now offered by The Fafnir Bearing Co.

These include not only new sizes in the present series, but also several entirely new bearings of the double felt-seal type. Known as the KF, KF-A, and DF series, the first two are designed with a single row of balls, while the DF uses a double row of balls.

These bearings, of which the K-A (single row radial with double metal shields) is an Army Air Corps standard, and the KF (a Navy standard) round out a line which conforms to specifications of aircraft engineers for weight, tolerances, dimensions, and proper radial and thrust capacity.

## NON-GLARE GLASS

Landing lights that light up the field brilliantly but appear to the pilot as only a faint glow when he looks directly at them—goggles that are clear and practically colorless yet eliminate entirely the reflection from water and road surfaces—strain testers that permit the simultaneous examination of an entire model plane for strain—these are a few of the aeronautical applications of Polaroid, the glare-eliminating glass.

In connection with strain tests the feature of Polaroid is its unlimited size. Photo-elastic properties of transparent models have been used for some time (particularly at M. I. T.) for plotting the points of strain in types of structure. Until now, however, the examination has had to be done one small section of the model at a time, because of the mechanical and optical limitations presented by previous sources of polarized light. Airplane models can now be made of clear bakelite or celluloid and viewed in their entirety with the new Polaroid tester. Motion pictures can be taken to show where and when the strain develops when loads are applied.

Land-Wheelwright Laboratories, Inc., Boston, Mass., have developed this new product.

IN THE AIR AND ON THE GROUND IT'S RCA ALL THE WAY!

# SAFE IN THE DARKNESS

**with RCA Aviation Radio Equipment to "Light" Your Way!**

*RCA equipment in three-fourths of America's Airports and most planes using them proves it's better!*

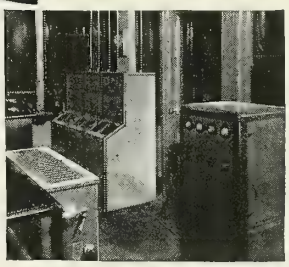
Flashing through an inky sky, it's comforting to know that in spite of the darkness all about you, there *is* a light to guide you safely home—the "light" that's furnished by RCA Aviation Radio Apparatus.

RCA equipment in planes and airports means flying that's *safe!* That's why three-fourths of the airports in the United States—plus nearly all the planes using them—own RCA radio products. And this almost unanimous vote for RCA is proof that the equipment bearing the famous RCA trade-mark provides ace-high service.

Every day more and more pilots are equipping their planes with RCA Aviation Radio products. Are *you* enjoying the safety and convenience benefits of airplane radio that's RCA ALL THE WAY? You can—easily and inexpensively! Why not look into it? Just send us a card, and we'll forward information, without obligation, telling you about the complete RCA line of aviation radio products for planes and airports.




"Right on the Nose!" After hours of flying in the darkness, the plane is brought in safely—its way "lighted" by the RCA equipment on board.



Allegheny Co. Airport, Pittsburgh, Pa., uses 5 RCA AVR-11 Airport receivers, each with an AVA-8 Crystal Control attachment. All are mounted in RCA MI-5747 Airport Traffic Control Tower Rack Cabinets. Also shown is RCA AVT-1A Airport Traffic Control Transmitter. Airport also has RCA AVT-1 Transmitter.

*RCA presents the "Magic Key" every Sunday, 2 to 3 P. M., E. D. T., on NBC Blue Network*

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# AERO *RADIO* DIGEST

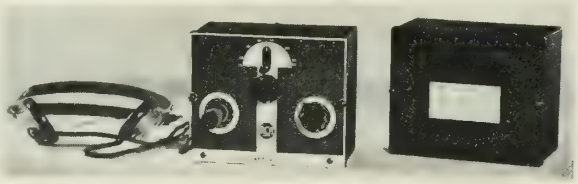
## Newest Developments in the Field of Aircraft Radio

### Lorenz B-L System

Lorenz system of instrument landing (AERO DIGEST, Oct. and Nov., 1936), developed by C. Lorenz A.G. of Berlin, has been introduced in this country by its parent company, International Telephone and Telegraph Corp., of New York, which gave a public demonstration of the system, on May 14 and 15, at Indianapolis Municipal Airport.

Long the standard system in Europe, where 26 airports in 11 countries have such installations in operation or under construction, the Lorenz instrument landing system has also been installed in Tokyo, Capetown, as well as at Indianapolis.

Identical in principle and similar in construction to the original Bureau of Standards system developed in this country in 1931, and the present Air-Track and UAL-Bendix systems now in operation at College Park, Md., and Oakland, Cal., the Lorenz system provides three-dimensional guidance along a pre-selected glide path to a runway within the airport limits.



*RCA Model AVR-10 aircraft receiver weighs only 8.5 lbs.*

Directional guidance is given by a dipole with two keyed reflectors; the interlocking dots and dashes of the reflectors merge into one continuous note along the equisignal line, similarly to the familiar radio range beacons; in effect, a two-course beacon.

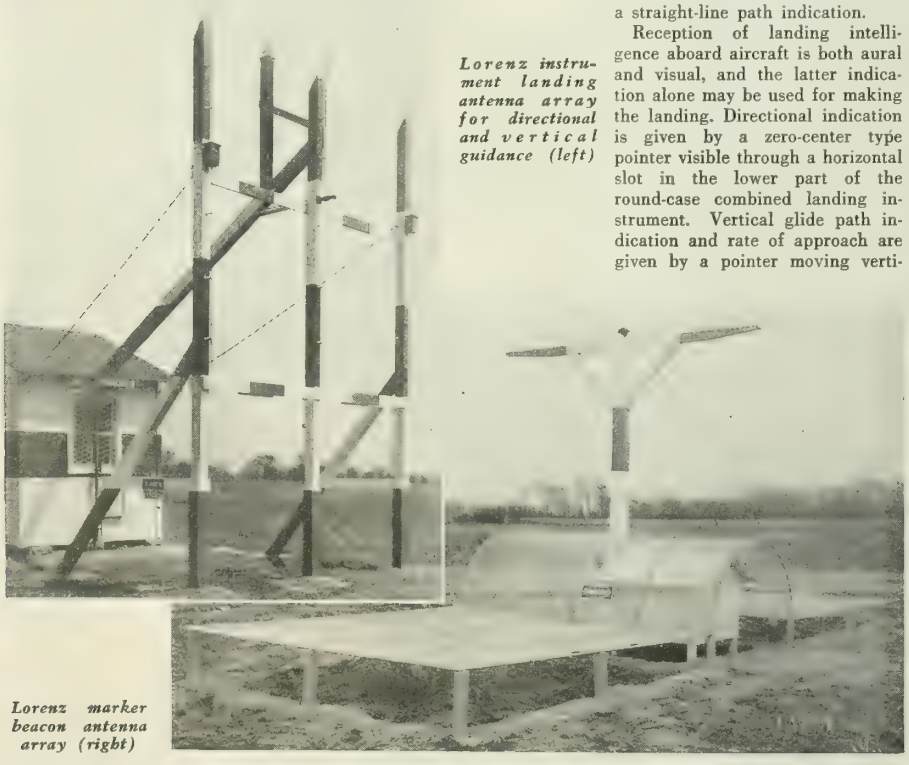
Absolute distance indication is given by two low-power short-range marker beacons—an approach marker, located about 1.5 miles from the field; and a boundary marker, located about 1000 ft. from the airport boundary.

Vertical guidance is given by a selected constant field intensity to which the indicating instrument is calibrated. In common with other similar systems, the curved glide path thus demarcated does not correspond to the normal glide path of an airplane; therefore, in the majority of cases pilots use the constant rate of descent method of landing approach, similar to that employed in our Army-Hegenberger system of instrument landing.

Inclined straight-line glide path, now being sought by several manufacturers, will probably be needed before any instrument landing system can be commercially applied to large aircraft with comparatively high landing speed, and will probably lead to the revival of the three-wheel landing gear to permit landing the ship in flying position. In the Lorenz system, the inclined straight-line glide path may be approximated by clockwork regulating instruments which reshape the normal curved-line indication into a straight-line path indication.

Reception of landing intelligence aboard aircraft is both aural and visual, and the latter indication alone may be used for making the landing. Directional indication is given by a zero-center type pointer visible through a horizontal slot in the lower part of the round-case combined landing instrument. Vertical glide path indication and rate of approach are given by a pointer moving vertically against a calibrated scale, visible through a vertical slot in the upper part of the case. The two marker beacons cause the appropriate colored lights to flash during the passage of the airplane through their respective fields, the approach marker light being at the left, and the boundary marker at right of the combined instrument dial.

*Lorenz instrument landing antenna array for directional and vertical guidance (left)*



*Lorenz marker beacon antenna array (right)*

### New RCA Receivers

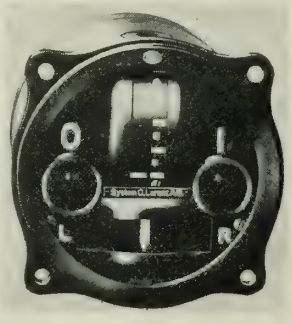
Two light-weight receivers known as AVR-10 and AVR-10-A, were recently announced by RCA Manufacturing Corp., Camden, N. J. Both are identical except for tube filament connections, and operate from 12- or 6-volt sources, respectively.

Circuit arrangement incorporates a tuned radio frequency system, consisting of a stage of high gain radio freuency amplification, a detector, and two stages of audio frequency amplification. Two recently developed pentagrid converter tubes (RCA 6F7) are utilized to deliver the equivalent of 4-tube performance, thus minimizing current consumption.

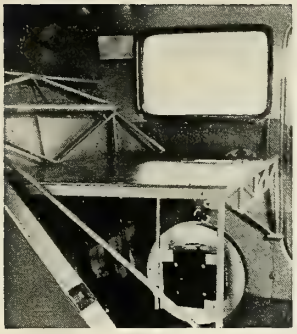
Power supply unit consists of a plug-in type inverter rectifier vibrator, with associated transformer and filter system. Model AVR-10 power supply unit draws .7 amp. at 12 volts (8.4 watts), and Model AVR-10-A draws 1.47 amp. at 6.3 volts (9.26 watts), either unit delivering 188 volts at 18 milliamperes to the receiver.

Easily installed in limited space, the receiver covers the radio range beacon and weather broadcast band, including airport traffic control (200-400 kc.). Receiver and power supply unit measure, each 6.5″ × 5.25″ × 3.5″ overall; the equipment includes a pair of 7 oz. 600-ohm low impedance phones and a 5-ft. interconnecting cable with plugs and battery lead.

Weight of the equipment, installed, is 8.5 lbs., without battery; because of low current drain, either storage or dry-cell battery may be used.



*Combined landing instrument gives simultaneous indication of direction, glide path and marker beacons*



*Interior of Bendix radio plane*

### Bendix Radio Plane

A Lycoming-powered Stinson *Reliant* was purchased by Bendix Radio Corp. for use in sales and experimental work. The specially-constructed cabin interior incorporates a spacious folding table, replacing the rear double seat, to accommodate radio apparatus being tested. The co-pilot's seat is reversed to face the table and will be used by the radio engineer observing tests. Right rear cabin window is hinged at the top, and an oversize door at the starboard side provides easy access into the cabin with bulky equipment.

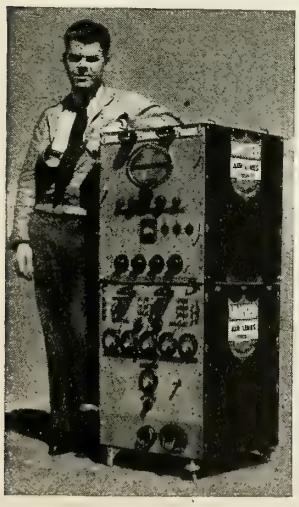
The ship will be based at Bendix, N. J., where the Bendix radio plant is now under construction.

### Submidget Controls

"Submidget" controls, about the size of a wristwatch, are offered by Centralab, Milwaukee, in either rheostat or potentiometer types, with insulated or ground shafts. These controls are used where resistance curve is not critical, chiefly in tone and sensitivity circuit locations.

Hollow brass or solid steel shafts are available; the bushing and shell are of steel, welded together; and all steel parts are cadmium plated.

Despite its minute size, when mounted on a metal panel, the control will dissipate 1.5 watts through the entire resistor without appreciable change.



*Tom Stangbye, of United Air Lines, with the relay transmitter*

### Radio Contacts

During the 6-month period ended April 30, a total of 150,121 radio contacts were completed between pilots and ground stations of American Airlines, Inc., according to James G. Flynn, superintendent of communications. This represents 99.5% completion of attempted contacts. Highest record of performance was in March, when 99.7% of attempted contacts were completed; lowest was in January, with 99.2% performance.

Daily average of 800 radio messages transmitted or received by ground stations included weather and special reports, and traffic control orders. Further increase in dependability is predicted when installation of anti-static equipment is completed on the entire fleet.

### Band Pass Filter

New band pass filter for use with existing aircraft radio receivers has been developed by Western Electric Co. The filter is intended for more convenient reception of the new simultaneous transmission of beacon signals and weather broadcasts on the Department of Commerce radio range network.

A 3-position switch is so arranged that in its center position the band pass filter is disconnected and the receiver responds to both beacon signals and weather reports. When the switch is thrown to one side, beacon signals only are passed through the receiver; when thrown to the other side, the beacon signals are eliminated and only the voice frequencies are received.

In the previous filters, changes in temperature or input voltage have caused a shifting of the band; this is virtually eliminated in the new filter, where the band shift is so small as to be practically immeasurable.

### UAL Relay Transmitter

Special 5-frequency short-wave transmitter for relay broadcasting work has been designed by United Air Lines and constructed in their Cheyenne radio shops.

The transmitter, installed in a stock twin-engined transport, was used in a series of broadcasts in flight over the nation's principal parks, in cooperation with the National Parks Service, rebroadcast by the Red Network of the National Broadcasting Co. each Sunday, April 25 to May 30.





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# Personalities

by Caldwell

• Millions of people have read his stories; probably a quarter of a million read him every month; he writes 3000 words a day, has written a 14,000-word novelette about one character every month for the past eight years, has written over 400 stories about aviation, Army, Navy and Commercial, rates as one of the top-notch writers of wild air stories in the world—and you've probably never heard of him! His name is Arch Whitehouse, an old ex-Royal Flying Corps gunner and pilot; and he writes for that amazing substrata of literature, "the pulps."

Pulps are read by the sort of people who think *Gone With the Wind* is a description of one of John (Downwind) Giesse's landings. Most of Arch's stories are the most frenzied of frenzied fiction, guaranteed to make a moron swallow his gum; but others are gems of descriptive air writing done with a dash peculiarly his own. One of his stories of a bombing raid against the Afghans couldn't have been done better by Kipling. But he can't be Kipling every day, with 3000 words to grind out. He's the Ford factory of literature. They used to marvel at how Edgar Wallace ground out stories. He was a piker compared to some palpitating pulpers. They are all slightly insane. But some of them make big money—and look down on fellows who write for the "slicks"—such as the *Post* or *Colliers*. So you can imagine what they think of *me!*

### Billy "Buzz" Benson

One of his characters, Billy "Buzz" Benson, is a newspaper aviation reporter on the surface, but actually a Secret Service man. He flies all over the country solving aerial mysteries—such as how Dick Blythe flies and still remains alive. Another Whitehouse character is Kerry Keen, a Raffles of the air, a man about town and a ballistics expert. But at night—ah, at night he becomes the Griffon, a masked figure who robs the rich to help the poor and himself. The Griffon has a secret hangar on his Long Island estate, *Sunken Chimneys*, and flies around in search of plunder. Arch gets 500 letters a month about that bird from readers who are so dumb they think the Griffon boards with him. But Arch lives with his son Arthur, aged 11, and his wife, Ruth, who he tells me is the only woman in America who hasn't said, "What has Wally Simpson got that I haven't got?" For this alone Ruth merits the Congressional Medal. After all, they gave it to a couple of "explorers" for less.

### Word Factory

In addition to his 3000 words a day, rain or shine, hot or cold, Arch turns out two detailed technical drawings a month, lays out two pages of photographs, keeps in touch with 20 stooges abroad for new material and photographs. Most of his fiction is rewritten after publication here, and sold in England with the 'ero given an Oxford accent and the thug a Shoreditch sniffle—Ruth does most of that for him. He had another English series, *The Casket Crew*, a gang flying around in Handley-Pages, kidnapping C. G. Grey, and so forth. Arch deals it out by the mile and chops it off by the yard for retail sale.



*Arch Whitehouse*

In his youthful days, when he was an air villain himself, he was a member of famed 22 Fighter Squadron, R. F. C., back in 1916 when it flew "Fees," (F.E.s) pushers that were pushed along by the mighty 160 hp. Beardmore or the Rolls-Royce *Falcon*. When attacked by Huns the Fees got on each other's tails, like elephants in a circus parade, and flew in circles, so the gunner in the front seat could protect the unprotected tail of the other pusher in front. This system worked unless the wind was blowing East, in which case they'd have to break off or be blown past hope of recrossing the lines again.

When these marvellous inventions became obsolete for fighting, early in 1917, they were donated to night-bombing squadrons powered with the old Beardmores, and 22 Squadron took a new lease of life with fine Bristol Fighters, in which they chased the great von Richthofen all over the landscape and softened him up for Roy Brown. From late 1916 until early 1918 Arch Whitehouse was with 22 as a machine-gunner and bomber, starting as a private transferred from the Northamptonshire Yeomanry, which he had joined in a moment of aberation in 1914, when he was only 19 years old. After two years in France as a gunner with 22 Arch had risen to the dizzy rank of Corporal.

### No Time Out for Tea

But not being smart, poor old Arch simply kept on firing his machine gun and dropping his little bombs on troops and indulging in other blithesome frolics, such as offensive patrols, and night attacks on back areas, and long-distance escort jobs to Gontrode and Bruges, during which time he watched 22 Squadron wiped out three times, with only the Major and himself left of the group he'd joined with. Down at Avesnes le Comte, in March and April of 1918, while Fritz was staging his big push and I was doing a little desultory night-bombing in the reluctant Fee, we had on the same aerodrome an SE 5 Squadron. They were set to doing trench-straffing, which is machine-gunning and light-bombing troops in trenches. That squadron started with a complement of 18 planes and pilots, and 4 in reserve, 22 in all; and two weeks later there wasn't one of the original group left. They were killed or wounded or crashed, or imprisoned, but a new lot of brave boys and new aeroplanes (I mean *aero*planes) were on the job and the war went right along—with me getting more and more thoughtful all the time and wondering how I'd ever been careless enough to get myself in a silly mess like that, even if my own night-bombing was comparatively safe—as safety went in those hectic days. If the United States gets into a war I may emigrate to Vermont. It's a funny thing, but men never get too smart to be soldiers until they're too old to be any good as soldiers.

### Brave but Dumb

Arch is brave, and dumb as he ever was: "Peace?" he writes. "You can have it. Look what it's done to you and me, and all the rest of the old gang. Ray Collishaw had the right idea. He's still in the R. A. F. ringing up his flying pay. He needn't worry about rejection slips or whether he can hit the deadline. A and B Flights will take early morning patrol and rendezvous with D. H. bombers over Houlthurst at 12,000 feet. Objective—enemy railroad siding at Therout. Boy, them wuz the days—especially when you were in C Flight." Just an old warhorse sniffing powder. He can have it. Of course, I don't say that if our country gets into a war I won't be in uniform—I might even fly an Army transport cautiously here and there, taking brave men to where they can do some fighting, or I may be carrying supplies, or Generals—and if you want to

avoid conflict about the best job would be private pilot to some General, inspecting back areas from the air to see if his Infantry was dug in deep enough. Yes sir, that's the job for a feeble aerial typewriter tactician—and there are a lot of fire-eating old Air Corps Reserve officers who talk about the fighting they'll do who will be competing with me for that same safety-first job. I'll probably have to fight off C. B. Allen and Dave Behncke, both wanting to fly General Craig as he goes out hunting for his Army. General, I'm applying for that job right now, and can guarantee that if you fly with me neither of us will ever hear a shot fired in anger. We just won't take that war seriously—I spent three years in the last one and didn't pay any attention to it, which is the only sane way to take a war. Besides, I went in for social life in France. Of course I was younger then."

Let's see—where were we? Oh yes, Arch Whitehouse. Well, it seems he was born Dec. 11, 1895, in Northampton, England, but his folks emigrated to this country and went native a few years later, and went broke a year after that. Young Arch had to quit school at the seventh grade, a whole year before I left my *alma mater*, so he has a slight advantage over me.

### Worked with Wizard

Arch went to work for Thomas A. Edison in West Orange, and in a generous mood Mr. Edison paid him $4 a week. Arch worked in the storage battery department and used to read nights. He got a complete education from the works of Charles Garvice, Bertha M. Clay, Burt L. Standish, and a particularly instructive volume about a foot thick known as the *Home Guide to Medicine*, with colored plates by the dozen that displayed all the more usual human organs. You don't seem to encounter those books any more, but every family had one when I was a boy, and when any member was ailing father would consult it and prescribe off-hand for anything from the croup to ringworms. I recall once he treated me for spavin, but as I showed no improvement we called in the local horse-doctor and he diagnosed my complaint as housemaid's knee. Mother fired the housemaid, and I soon recovered.

### Then Came the War!

One day Arch—this was after he had learned to read—saw a newspaper headline, "Great Britain Declares War on Germany." He rushed to the British Consul's office in New York, mentioned that he had been born in England, and the next thing he knew he was in Halifax, where he and 800 horses were loaded aboard the *Etonian* bound for the war. Two years later I was eating pieces of those same horses, because when the English found that Cavalry wasn't getting anywhere they fed the mounts to the troops. They called it beef, but some of us knew the difference. For two years Arch and the Yeomanry fought the war in the mud and then he got smart and asked for a transfer to the Royal Flying Corps, naturally expecting to be sent to England to become a pilot. Instead, they sent him to a field used by No. 22, and 20 minutes later he was in the air in a Fee, trying to hit a white target on the ground with machine-gun bullets.

### Remarkable Marksman

On his first practice gunnery flight he put several bullets in the target, set a haystack on fire, and—as the pilot turned while Arch was still holding the trigger—put a burst through the roof of the mechanics' mess and ruined the piano. He was therefore considered graduated and the same afternoon went on patrol and was credited with shooting down a Hun. He still doesn't believe he did it, because he just shut his eyes and fired; but an unfortunate Heinie must have flown into the burst, for they gave Arch a medal later on, as next day he shot down another one, and was made 2nd Class Air Mechanic Whitehouse, Aerial Gunner, with flying pay.

After two years of this the Army got soft and let him go back to England in January, 1918, first to Hastings and Grantham and then to learn to fly Camels at Cranwell, where in the summer of 1918 I also had retired from the war, thank God, and was teaching infants to fly Fees and Handley-Pages at night. We had all ages and sizes of male humans there, from hard-boiled old gunners with active service records like Arch, down to mere downy cheeked children like James Warner Bellah, also toying with D. H. 9s at that time.

### Our Trails Crossed

That's where I first met Arch Whitehouse, and Jim Bellah, too, and it's a sad commentary on the fate of old and young soldiers that we all ended up as writers, more or less, with Jim the only one who really got anywhere and became rich and famous. Yes, Arch, I guess after all you and I should have stayed with the R. A. F. I tried to—but they were too smart for me and sent me back home.

(*Continued on following page*)





Yes, boys, it's one smooth plane . . . a job to catch the eye of any pilot! Look at those lines! Neat . . . slick. And look at that finish! Colorful . . . beautiful . . . thanks to Sherwin-Williams! ▸ There's more than meets the eye in the Sherwin-Williams Airplane Finishes that give snappy beauty to Arrow Aircraft's "V 8" ships. They keep fabrics taut and smooth . . . add safety, speed. They protect against heat and cold, rain and sleet. ▸ Sherwin-Williams Airplane Finishes do all these things and more and do them economically . . . strictly in keeping with Arrow's low cost requirements. Arrow knows the best costs the least in the long run! ▸ You'll want all the facts about S-W Airplane Finishes. Write for them to The Aeronautical Division, The Sherwin-Williams Co., Cleveland, Ohio.

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(*Continued from preceding page*)

We had another young fellow there at Cranwell who since has got quite prominent—the present King of England. He was an R. A. F. officer then and learned to fly, more or less. Mostly less. He wasn't at all suited to flying; it would have been better to put him in the Coast Artillery and leave him gazing quietly out to sea for the duration of the war. He'd have preferred that, too, even to being King, a job that calls for someone like Roscoe Turner to do it full justice. What a King old Roscoe would make! King Roscoe! Any time King George VI wants to abdicate, Baldwin should cable Roscoe. He'll take the King's job and Baldwin's too, and sell oil on the side, and still have plenty of time to get himself fitted with new uniforms each month. I'll have to tell you the story, one of these days, of how I acted as Keeper of the Lion for King Roscoe in a Chicago loop hotel one awful night when the lion was over half grown. Roscoe, when they make you King I want my old lion job back again. But this time I'll take lessons from Clyde Beatty so I won't end up in the closet with the lion in charge.

### Scaring the Zepps

Arch Whitehouse was graduated from Cranwell and went to the East Coast on Camels to leap into the air at night and protect the proletariat against Zeppelins and Gothas—a job that I also had two years earlier, on the North East Coast. The Zeppelins must have heard I was there, for they never came over in that territory during my tour of duty, and the Gothas only came over further South. It was a dull war on home defense. Arch lasted at that until peace broke out, when he came back to this country with a medal and a wound stripe—he had stopped a piece of shrapnel over St. Jean in '17 and covered himself with glory and the aeroplane with gore. He came home with Jim Bellah and they both got jobs at $18 a week in an insurance office until a Wall St. explosion blew them out.

### "Hell's Bells" Bellah

Bellah landed in Three Rivers, Quebec, checking lumber, and started to write his Hell's Bells O'Neil stories, which Frank Tichenor published in AERO DIGEST. That started Jim on the road to fame, such as it is. Arch married the girl he'd been in love with since the seventh grade and tried selling rat poison, but the rats wouldn't buy any. In desperation he landed on a Passaic (that's over in New Jersey, you dopes) paper as a reporter, drifted to sports writing, and then to pulp fiction, at which he's a wiz. He has written his life story for a magazine, and a play "Forty-Four", in collaboration with Jim Bellah, which Gilbert Miller was going to produce, and now thinks he isn't going to. In case any of his old friends want to know, his address is 112 Passaic Ave., Chatham, N. J.

### Old Number Nine

One more yarn about this old writing pilot and then I'm done. He and I and several other pilots used to have a volunteer job that is now out of existence—walking ballast on an airship. It was old No. 9, an English wooden-framed dirigible patterned on Zepp lines, built in 1914 or so, and used for training at Cranwell. The performance of this dubious air monster was as wooden as its frame. It had a speed of less than 30 miles an hour. Cows and horses we frightened used to beat us to the other end of the pasture. It's ceiling was said to be 1000 feet, but it never got higher than about 500 and preferred 200. Commander Scott and a Lieutenant named Tookey Jones used to command this creature. We pilots and No. 9's crew of enlisted men would be the ballast. If they wanted the nose to go up, we'd scamper to the rear; if they wanted to nose down, we'd rush to the front end along a catwalk.

Why we never fell out of it I still don't know, unless Newton's Law was not in force then. Toward the end of a flight we'd be leaping along that catwalk like young monkeys at the command of a Chief Petty Officer. I think nearly everyone at Cranwell had a ride in that thing one time or another—it was the comedy relief of the war. Once we got up and couldn't get down. A strong wind sprung up and we couldn't land and couldn't even remain over the aerodrome. At full speed ahead West, we were going East toward the North Sea backward. As the sun went down, so did the wind, and us with it. I don't recall that any of us had sense enough even to feel relieved—we'd never been conscious of being in any danger. It was filled with hydrogen, too, like the late *Hindenburg*, but we were as undisturbed and happy as though it had been filled with laughing gas or Haig & Haig.

The book says of No. 9—"She did not quite fill the contract requirements in respect to disposal lift until a number of alterations had been made." A gross understatement!

When you consider the early days of Arch Whitehouse it isn't surprising that he ends up as a writer of pulp paper fiction. He certainly had the right training for it.

# DIGEST OF THE NEWS

## PRIVATE FLYING

### Shows and Tours

Lieut. Joe Mackey, winner of the Freddie Lund trophy for precison aerobatics, headlined an air show program, April 11 at the Springfield, Ohio municipal airport. More than 35,000 persons attended. Others who participated were: Mike Murphy, stunt pilot; Earl R. Stein, bat-wing parachute jumper; Bill Sweet, W. Myron Hightower, E. S. Leach, Carl Middleton, Don Walters and W. B. Little, all members of the Ohio Oil Company's Linco Flying Aces.

* * *

The American Legion is sponsoring the official opening of the Nashville airport on June 12 and 13. Among those expected are Roscoe Turner, Louise Thaden and the Key Brothers.

* * *

Indiana Pilots Association has set the dates for the Indiana Air Tour for the entire week of June 14-20.

* * *

More than 250 pilots are expected to particpate in the week-end tour to Del Monte, Calif., sponsored by the Aviation Country Club of Los Angeles. The pilots will visit Phoenix, Ariz., Santa Barbara, Bakersfield, Fresno, San Francisco, Oakland and Alameda. The start is set for June 19.

The last tour staged by the club which was limted to club members found 160 persons flying their private planes to Ensenada, Mexico for a week-end visit.

Secretary Bert Rhine reports that the increase in private flying in Southern California has resulted in a 50% rise in the club's membership the last year.

### State Officials Meet

Conference sessions centering around the three research studies being made by committees of the National Association of State Aviation Officials were held at St. Louis from May 27 to 29. Elwood B. Cole, of Illinois, was in charge of the airport research; Charles L. Morris, State Director of Aeronautics for Connecticut, presented the findings on insurance; and Gill Robb Wilson, of New Jersey, told of developments in aeronautical education and training.

Practically every state was represented and the sessions were addressed by men who have specialized in these various lines of activity.

Since the resignation of Fred Fagg as secretary of the association to accept the directorship of the Bureau of Air Commerce, Howard Knotts, of the Illinois Aeronautics Commission, has been elected to fill his position.

### Taylor Award

W. T. Piper, president of Taylor Aircraft Co., has instituted a competition whereby five college graduates of the class of 1937 will receive a complete training course in aeronautics and a Cub plane at completion of their course.

The competition, which will be held annually, is sponsored by the Taylor company in conjunction with the National Intercollegiate Flying Club. Forty Chapters of the N. I. F. C. at leading colleges and universities in the U. S. are participating.

Under the plan five college graduates who are selected for the Piper Award will join the Taylor company for a period of two years. During this period they will be on the payroll of the company and will receive 200 hours flying instruction. In additon, they will be trained in all departments of the factory and will attend a night school, at which time they will be trained in salesmanship and all other phases of the aircraft business.

Selection of the men to receive this training will be made on the merit basis by the Alumni Advisory Board of the N. I. F. C. Qualification for aviation will be the first consideration in selection, although, aeronautic experience and accomplishments made possible through participation in college flying will be an important consideration.

### Soaring Preparations

Soaring facilities equal to those in Germany, England and France will be available to American pilots when the Eighth Annual National Soaring Contest opens at Elmira, June 26. Permanent buildings providing modern conveniences have been erected on

(*Continued on following page*)

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Purchase of the well-known and time-tested SZEKELY engine, with parts and machinery—for manufacture.

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AERONAUTICAL CORPORATION OF AMERICA — AERONCA — Lunken Airport Cincinnati, O.


(*Continued from preceding page*)

Harris Hill, the headquarters soaring site.

A project which includes a large administration building, a fireproof hangar, comfortable sleeping cabins and bath houses, has been completed and a swimming pool is in the process of construction. In addition, the 1500 ft. runway on the take-off site has been graded and leveled.

### 934,263 Passengers

Miscellaneous flying embracing civilian operations other than that of scheduled airlines, and including charter and taxi service, flight instruction, experimental and test work, special services like crop dusting and photographic flying, and private flying, was responsible for 51,803,290 miles of flight in the last 6 months of 1936. During this period 934,263 passengers were carried.

The mileage flown total was the highest for any six-month period since July-December, 1930 and the passenger total was the greatest since July-December, 1931.

### Aviation Week

Fred P. Cone, Governor of Florida, has set aside the week of June 21 to June 26 as Aviation Week in Florida. In conjunction with this observance, the Florida Aviation Association is sponsoring a tour to take place during this period, and to coincide with its annual meeting at Orlando.

Tour planes will leave Orlando June 22 for Jacksonville, then will visit Tampa, Lakeland, West Palm Beach, Miami and Melbourne where they will disband. At Miami there will be a "Parade of Progress" on June 26.

### Club News

Members of the Wellston (Ohio) Flying Club have purchased a new airplane, and a number of students have enrolled for instruction, according to William Patterson, club organizer. An airport is being constructed at Hamden, near there.

* * *

Newly-elected officers of the St. Joseph Valley (Ind.) Aviation Club are Forrest Miller, president; Louis Taylor, vice-president; Vernon Hagg, secretary; Stanley March, treasurer. Members of the board of directors are: E. J. Davidson, C. R. Bowers, R. Johnson, and the trustees include George Fetters, George Sweisberger, and Ray van De Viere.

* * *

A new cooperative club has been organized in Richmond, Ind. to promote private flying. Activities consist of a complete ground school course covering 17 subjects and flight training in a Kinner Bird. The ground school course will consist of one year of instruction and 260 hours school time. Officers are R. Brewster, president; H. McBride, vice-president, and Lee Jenkins, secretary and treasurer. Present membership includes 9 men and 3 women.

### Commemorative Flight

Twenty-five years ago on May 10, 1912 Glenn L. Martin made a flight across the channel from Newport Bay to Santa Catalina Island in a hydroplane fitted with a wooden pontoon built of bamboo struts and a reconstructed engine.

Martin celebrated the silver anniversary of this flight by flying the same course—this time in a trans-Pacific Clipper ship of his own design. A special cargo of mail was carried on the flight, special cachets commemorating the event.

## SCHOOLS

### Boeing Scholarships

Winners in the eighth annual W. E. Boeing Scholarships contest include R. Dickson Speas, Massachusetts Institute of Technology, first; Robert T. Lamson, University of Washington, second; William A. Wichers, Hope College, third; and George T. Hayes, Riverside Junior College, fourth.

First award is the $6040 Boeing Airline Pilot and Air Transport Engineering course; other award winners receive the Amateur Pilot flying course, plus a choice of one of five courses. Total value of all courses is more than $11,000.

Award committee was composed of Dr. Baldwin M. Woods, chairman; William B. Stout, Dr. Frank Hockema, and Dr. Otto C. Koppen.

### Personnel Notes

Howard Engler has joined Ryan School of Aeronautics faculty as assistant instructor in sheet metal. Engler and Vincent Hamilton, welding instructor, will assist Virgil McKinley, chief of the airplane school, and Fred Magula, superintendent of sheet metal in this department which the school has expanded to keep pace with the increased use of sheet metal construction.

* * *

Wiley Post Airport Flying School, Oklahoma City, has added John Cook to its flying instructor staff. Cook is also a member of Braniff Airways' traffic department.

### New Equipment

Parks Air College has purchased a Taft-Pierce boring fixture for radial engine rods. This machine is a late development and will accurately bore master rod bearings, piston pin bushings, and both ends of link connecting rods.

Herbert J. Zimmer, assistant superintendent of the Master Mechanic's school will supervise the work on the machine.

* * *

A Taylorcraft monoplane has been delivered to Lapham Flying Service, Battle Creek, Mich. for instruction and solo work at the W. K. Kellogg airport.

### Enrollments

Students from 11 states in this country, from Canada, Hawaii, and Japan were enrolled in the Boeing School of Aeronautics for the spring semester. Courses of study chosen by this group include the airline technician, airline mechanic, airline operations, transport pilot, private pilot and aircraft sheet metal courses.

Fifty students are enrolled in the various flight courses at the school, 37 taking the extensive airline pilot and operations course.

### Homestudy Courses

Theodore A. Woolsey, president of Aeronautical Institute of Los Angeles, is offering two complete courses in a new homestudy plan. These courses cover aircraft drafting and aeronautical engineering, and in addition there is also available a special course consisting of 40 lessons in homestudy and two weeks (80 hours) of finishing training at the school. This plan has been worked out with several shop foremen of some of the aircraft manufacturers in the Los Angeles area.

### New Schools

A $200,000 school intended for the training of mechanics and engineers is under way with the beginning of construction work on an administration building near Grand Central Air Terminal, Glendale, Calif. Permits for three other buildings have been applied for.

The new institute will be controlled by an advisory board consisting of John K. Northrop, pres. Northrop Corp.; Edward Zuchelli, of the Northill Co. who will be executive vice-president and general manager; Chas. Van Dusen, vice-pres. and works mgr. of Consolidated Aircraft Corp.; and Robert Gross, pres. Lockheed Aircraft Corp.

* * *

Arbogast Aero Service, Long Beach, Calif. has started a school in aircraft welding at its base on the municipal airport there. Chief instructor is Glenn L. Arbogast, and Edward Neff is registrar.

## AIR SERVICES

### More Navy Fields

Need for additional outlying fields for training purposes has resulted in the recent acquisition of three landing fields in the vicinity of Pensacola. These are "K" Field, located near Gonzales about ten miles north of the Air Station; Bayou Field, on the Big Bayou and adjacent to the Gulf Beach Highway; and Fountain Field, located about nine miles northwest of the Air Station. Bayou Field will be used as an advanced base for gunnery planes.

### Personnel Notes

Rear Admiral Charles A. Blakely, U. S. N., Commandant of the Naval Air Station, Pensacola, has been ordered to command Carrier Division Two, Aircraft, Battle Force, which will be composed of the new aircraft carriers *Yorktown* and *Enterprise* and their aircraft squadrons. The Admiral will will assume his new command early in August. The *Yorktown*, which has been assigned as Flagship of Carrier Division Two, is scheduled for commissioning during the summer, and according to reports from the Newport News Shipbuilding and Dry Dock Co., the *Enterprise* will be completed about Sept. 9.

Both vessels will join the United States Fleet after the completion of their shakedown cruises.

Aircraft squadrons of the *Yorktown* started assembling at the Norfolk Naval Air Station in April and those of the *Enterprise* will be assembled there soon. The squadrons will be based at that station for training until they are embarked in the carriers.

Capt. William F. Halsey, U. S. N., now commanding the aircraft carrier *Saratoga*, will relieve Rear Admiral Blakely as commandant at Pensacola on June 30.

* * *

Maj. Edwin J. House, former commander of the 94th Pursuit Squadron, has been named commanding officer of the First Pursuit Group, Selfridge Field. He succeeds Lieut. Col. Ralph Royce, who left Selfridge Field May 14 for duty in the Philippines.

### Orders for Planes

The Navy Department has awarded three contracts and the War Department one covering the purchase of aircraft.

One Navy contract went to Grumman Aircraft Engineering Corp. for 15 VJ-type amphibions. Some of these general utility ships will be used as replacements for those now in service and others will be assigned to the Naval Reserve. Amount of this contract was $571,923.

Another Navy order was awarded to the Lockheed Aircraft Corp. Totaling $205,513, this calls for the purchase of four twin-en-

(*Continued on following page*)





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Now you can visualize the final appearance of your plane *before* finishing starts! The amazing new Berryloid Colorgraph Visualizer shows 190 combinations of long-lasting Berryloid Pigmented Dopes—displays their contrasting colors as they will actually look on the airplane. The fuselage-shaped Visualizer indicator reveals one color surrounding the other just as a side view of a plane shows the wing against the fuselage!

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*Powered by four Pratt & Whitney Twin Wasp engines, the XB-15 Boeing bomber is the largest military airplane*

(*Continued from preceding page*)

gined Lockheed 12 transports. These planes, intended for use of Navy personnel, are powered by P & W Wasp engines, carry six passengers, two pilots and cargo at a cruising speed of 213 mph.

The third recent award was for 83 scout-observation planes costing $2,119,687, and manufactured by the Curtiss Aeroplane Div. of the Curtiss-Wright Corp.

Contract with North American Aviation, Inc., for U. S. Air Corps basic training planes was increased to provide for the purchase of 73 more units and spares, the additional cost to the War Department being $903,380.99. Forty of the 73 planes are being changed from the original design to take a more powerful engine of the P & W Wasp R-1340 type. The remaining 33 will incorporate other changes to provide for training pilots in the Reserve Corps, the changes being made to fit these planes for service at points other than the Air Corps Training Center.

### Army Airport

The Colorado National Guard is receiving $56,000 from the state to complete under WPA agreement, a new hangar at the Denver municipal airport, where the unit is to be moved when the government-operated Lowry field is abandoned this summer.

### Navy Appropriation

Naval aviation has been allotted $49,500,000 in the 1937-1938 Navy Appropriation Bill signed by the President. Of this amount $27,186,000 is earmarked for new construction and procurement of aircraft and equipment, spare parts and accessories. The bill also allows the Secretary of the Navy, prior to July 1, 1938, to contract for $15,000,000 worth of new aircraft in addition to the amount set aside for similar purchases.

Other funds in the total appropriation were set aside for the following: $750,000 for navigational, photographic, aerological, radio and miscellaneous equipment for use with aircraft built or building on June 30, 1937; $18,064,000 for maintenance, repair and operation of aircraft factory, air stations, fleet air bases, fleet and other aviation activities, as well as for the purchase of special aviation clothing and special equipment; and $3,500,000 for continuing development and experimental work and salaries of scientists and technicians employed in this work.

Attempt by the House to limit in the bill activities of the Philadelphia Naval Aircraft Factory met with opposition in the Senate sub-committee and the move to prohibit the Factory from competing with private industry in the manufacture of aircraft, engines and equipment, was balked.

## AIRLINES

### 74,972 Passengers

Measured by Bureau of Air Commerce reports for the first three months of 1937, scheduled air transportation seems headed for another record year. Twenty companies operated scheduled service during March and carried 74,972 passengers, which, added to the 46,012 and 58,008 carried in January and February, respectively, brought the three-month total to 178,992. This compares with 156,317 passengers flown during the first quarter in 1936, and with 70,926 carried in March, 1936 alone.

Increases also were noted in the number of miles and passenger



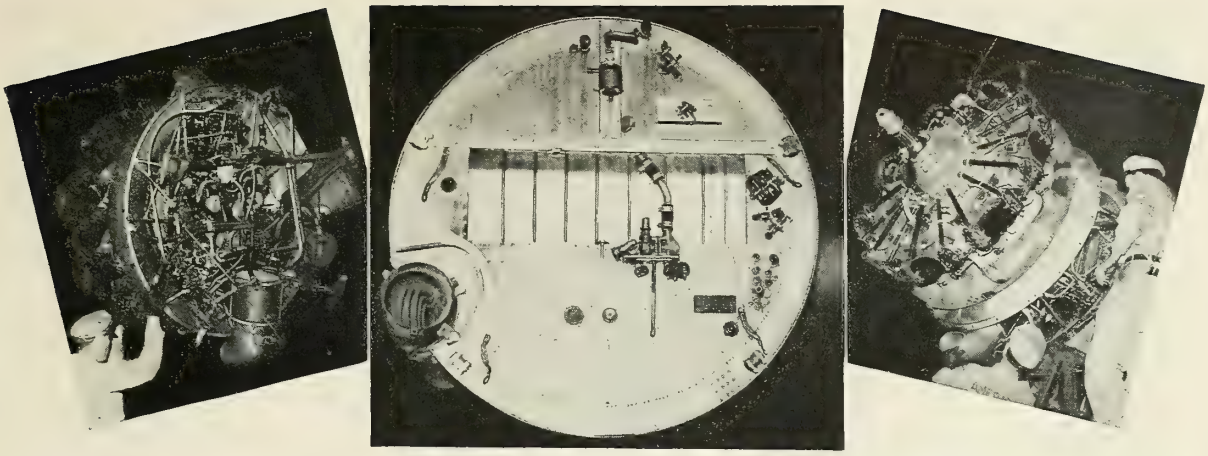

Tom Colby intentionally lands his 225 H. P. Jacobs powered Beechcraft in a rough mountain meadow 7,000 feet above sea-level and surrounded by the jagged peaks of The Jackson's Hole Country of Wyoming.

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RUGGED DEPENDABILITY

The eager climbing ability and slow, safe landing speeds of Beechcraft airplanes, together with their innate sturdiness and high cruising speeds have won high regard for Beechcrafts wherever unquestioned dependability is a prime essential. The ease with which Beechcrafts are flown has converted many top executives to the practice of flying themselves and their guests.

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*Views showing simplicity and ease of removal of a Cyclone engine unit from an American Airlines Douglas Flagship*

miles flown, in the number of passenger seat miles flown and in air express poundage. In March, 1937, the airlines flew 5,485,569 miles, carried 580,602 lbs. of express, and flew a total of 34,583,708 passenger miles.

* * *

Traffic on American Airlines during April 1937 was the best for that month since inception of the company, 21,698 passengers being carried compared with 16,767 in April, 1936, a gain of 30%. Largest increase was on the Southern Transcontinental route, traffic on this section gaining 78% over that a year ago.

* * *

Air express shipments for March exceeded the total for the corresponding month of 1937 by 46.21%, according to the Railway Express Agency.

## Personnel Notes

Chas. E. Beard, general traffic manager of Braniff Airways, has been elected to the board of directors and appointed vice-president in charge of advertising and traffic.

* * *

A new stewardess uniform will be designed by Louise Mulligan who has been named official stylist for American Airlines.

* * *

United Air Lines announced the following changes in personnel: Selly Hall, former assistant to vice-president in charge of operations, promoted to general superintendent of operations; R. T. Freng to succeed E. P. Lott who resigned, as chief of flying; and Bennie Howard to the post of flight research engineer. In his new position, Ben is pilot and flight engineer of United's flying laboratory, a twin-engined Boeing 247-D.

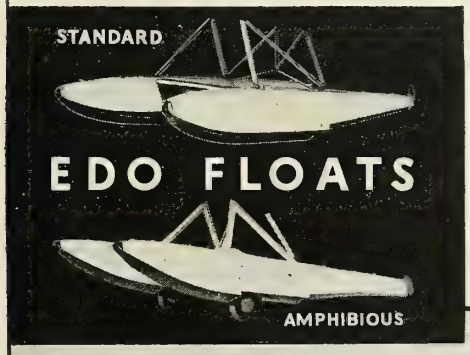
## New Equipment

Delivery of the first of eight Lockheed S-14 transports to Northwest Airlines is scheduled for early summer. Powered by two P & W Hornet S1EG engines, rated 850 hp for take-off, these

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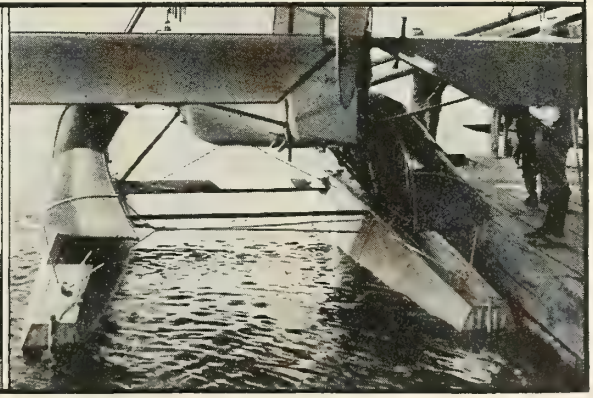

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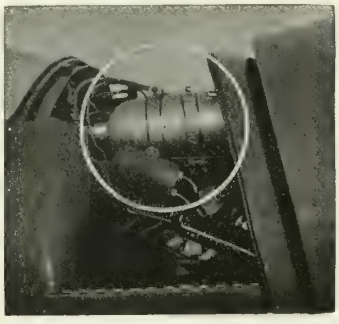




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LUX AIRPLANE FIRE SYSTEM


*(Continued from preceding page)*

10-passenger planes will have a cruising speed of 230 mph and a range of 2000 miles as well as the ability to take-off, fully loaded, on one engine and climb to 12,000 ft. They are equipped with galleys for serving hot meals and can carry about 2000 lbs. of mail and express.

### Schedule Revisions

Mail service to Pontiac. Mich. from Detroit, included in daily round trips on the Detroit-Flint route operated by Pennsylvania-Central Airlines Corp. has been discontinued due to the small amount of mail carried.

* * *

Slow progress in improving the Omaha airport has resulted in elimnation of all night stops there by United Air Lines' transcontinental planes and some day stops.

* * *

American Airlines, Inc., reduced its running time to the west coast with the Skysleeper *American Mercury*, which now leaves Newark at 5:10 pm daily but arrives in Los Angeles 20 minutes earlier, at 7:30 am. Three stops are made enroute—at Nashville, Dallas and Tucson, bringing flying time westbound to 17 hrs. 20 min.

* * *

Featuring 15 hr. 10 min. flights from California to New York, United Air Lines last month inaugurated two daily round-trip schedules from New York and Chicago to Los Angeles and New York with Skylounge type Mainliners. Intermediate stops between New York and California are being made at Chicago, Cheyenne and Salt Lake City. Passengers leaving New York at 5:55 pm reach Los Angeles at 7:59 am and San Francisco 8:24 am. On the other schedule, passengers departing from New York at 8 am reach Los Angeles at 11:59 pm and San Francisco at 12:29 am.

In addition, United is continuing two daily round trip flights with Boeing 247-D equipment, with more frequent stops, and has inaugurated local type service between such points as Chicago and Omaha, and Chicago and Cleveland.

* * *

New Transcontinental & Western Air schedules on the transcontinental route offer a service of 15 hrs. 20 min. eastbound and 17 hrs. 8 min. westbound.

TWA's *Sky Chief* flights eastbound leave Los Angeles at 4:30 pm (PT) arriving New York at 10:50 am (ET). Westbound flights depart New York at 5:00 pm and arrive in Los Angeles at 7:08 am or 31 min. earlier than before. Forty-one minutes have been eliminated from the former westbound schedule of the *Sky Master*, which now departs from New York at 11:59 pm and arrives in Los Angeles at 4:36 pm.

* * *

Delta Air Lines has shortened by 30 min. schedules between Shreveport and Charleston, S. C., by addition of a Lockheed *Electra*. The line reports an increase of 112% in air travel from Shreveport in the first quarter of the year as compared with last year.

* * *

Improved service from Detroit to Flint, Lansing, Grand Rapids, Muskegon and Milwaukee became effective when Pennsylvania-Central Airlines put Boeing 247-D transports into service on its western division. These planes replace equipment formerly in use on the route through Michigan and are the same type as the fleet recently put into service from Detroit to Cleveland, Pittsburgh and Washington.

* * *

Boston-Maine—Central Vermont Airways has started faster service on the Vermont line and changed schedules on the Maine line by which later service to and from Maine are provided on the afternoon trips. Lockheed *Electra* planes have been restored on the line between Boston and Burlington.

* * *

Through service between Tulsa, Okla., and Minneapolis, Minn., was inaugurated May 17 by Hanford Airlines. Under the new schedule, planes leaving Minneapolis at 12:45 pm daily arrive at Omaha at 2:35, Kansas City at 4 pm and Tulsa at 5:59 pm. The new schedule northbound provides for departure from Tulsa at 6:45 am, with arrival in Kansas City at 8:14 am, Omaha at 9:55 and Minneapolis at noon. This schedule, flown by new Lockheed *Electras*, is an additional schedule.

* * *

Non-stop 1 hr. 59 min. service is now offered between New York and Montreal, Canada, by Canadian-Colonial Airways. The new service is operated by American Airlines, Inc., under contract with the Canadian company and places in international operation 21-passenger Douglas Flagships.

### Lower Fares

Uniformity in airline fares on coast-to-coast and inter-city service has been achieved.

United Air Lines and American Airlines have reduced their fares between New York and Chicago and between both coasts, charges now being $44.95 and $149.95 respectively. TWA recently adjusted its fares to conform to the new rate structure.

All three lines are offering extra

fare services, United on its Sky Lounge Mainliners and Sky Sleepers, American on its Flagship Sleepers, and TWA on its new Sleepers and lounge planes.

Rates between other cities over the routes flown by these companies also have been readjusted correspondingly.

### Barographs Installed

Specially-built barographs have been ordered for United Air Lines' fleet of Douglas and Boeing twin-engined airliners to provide a constant record of flight altitude maintained on every schedule.

The company has been testing two barographs built by the Julian P. Frieze Co. Dispatchers and flight supervisors will check the running records provided by the barographs to make sure minimum flight altitudes are observed in scheduled operations.

## AIRPORTS

### Trans-ocean Base

Work is now well under way on the establishment of a trans-Atlantic air terminal at Charleston, S. C. The city has indicated that $150,000 will be spent in converting the site on the east bank of the Ashley river, within a mile of the business district, into a base equipped to handle the Clipper planes which will fly the 882-mile Bermuda-United States (Charleston) leg of the transoceanic route.

A building is being remodelled to serve as headquarters for the terminus, and 10,000 cu. yd. of dry fill will be moved to raise the height of the base area.

### Personnel Changes

Newly appointed sales manager for Aircraft Industries, Inc., Grand Central Air Terminal, Glendale, Calif., is Ted Lynn, formerly with Air Associates in Chicago and Glendale. He will be in charge of Stinson, Wright and Lycoming sales and promotion.

* * *

W. L. Williams, city supervisor of Love Field, Dallas, Tex., has resigned.

* * *

Dover, Del. municipal airport has been reopened by Howard Turpin who will act as manager and operate a fixed base business.

### New Fields

Four Mississippi airports now under construction or being improved, will soon be opened. The Biloxi airport will be completed by June 1, with exception of a large hangar. The Jackson airport already has been dedicated and passenger and mail services of Chicago & Southern Air Lines are expected to be restored. Delta Air Lines also may use the facilities of the rebuilt field.

Key Field at Meridian is being completely renovated with a new taxi strip paving, hangars and lighting system installed. An airport at Greenwood is now under construction, $40,000 having been allocated by the WPA.

* * *

An emergency airport, six miles northwest of Longview, Tex., has been opened and will be used by the nearby towns of Kilgore, Gladewater and other Gregg County communities. The airport is operated by L. A. Taylor with the cooperation of the aviation committee of the Longview Chamber of Commerce, chairman of which is Joe L. Grimes.

* * *

Bonds to provide for the purchase of a $500,000 airport site were included among those passed in a recent election of voters in Houston, Texas.

### Wiggins Airways Expands

E. W. Wiggins Airways, Inc., has taken over the flying and hangar operations at the East Boston Airport formerly conducted by Shobe Airlines, Inc., a school and charter service. The Shobe company will, however, continue as New England distributor for Beech aircraft, and Charles S. Cowan will continue as chief pilot and general manager for Wiggins.

The Wiggins company now operates stations at Rhode Island State Airport, Providence, Metropolitan Airport, Norwood, Mass., and the Boston Municipal Airport. The company recently was appointed authorized sales and service station for Jacobs engines at Boston and Providence.

## INDUSTRY

### Bureau Reorganized

Perfection of plans for the reorganization of the Bureau of Air Commerce provide for an organization headed by a Director of Air Commerce, an assistant director and seven divisions within the Bureau, each delegated to a specific task. Action results in elimination of the former set-up wherein the Director of the Bureau was aided by two assistant directors, each of which was responsible for separate functions.

Personnel, in addition to Fred D. Fagg, director of the Bureau, includes Howard Rough as his assistant to succeed Major Schroeder who joins United Air Lines, and E. B. Cole, technical assistant to Fagg and Rough.

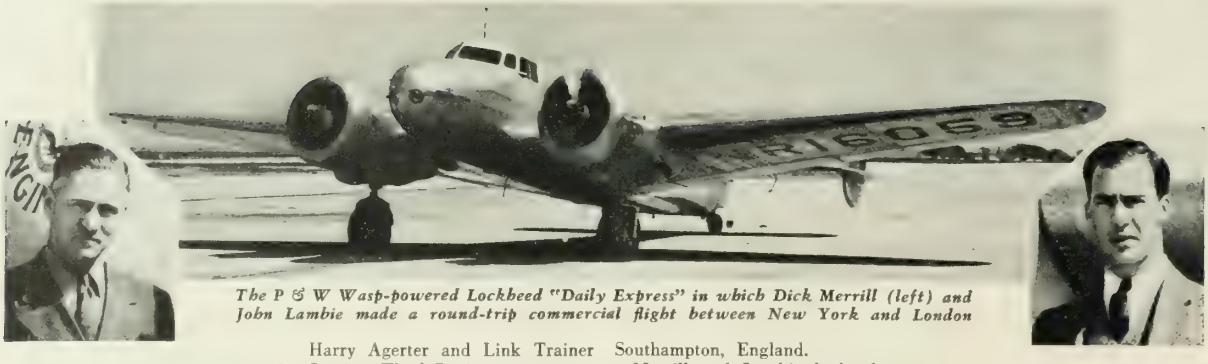
New divisions organized under the plan include Airways Engineering headed by C. I. Stanton;

(*Continued on following page*)




WEATHERHEAD Parts for AVIATION

ALUMINUM FITTINGS • HYDRAULIC BRAKE HOSE
VACUUM, OIL PRESSURE, GYROSCOPE HOSE



*The P & W Wasp-powered Lockheed "Daily Express" in which Dick Merrill (left) and John Lambie made a round-trip commercial flight between New York and London*

*(Continued from preceding page)*
Airways Operation, headed by Earl F. Ward; Safety and Planning Section; Administrative, John S. Collins; Information and Statistics; Certificate and Inspection headed by Bryan M. Jacobs and Regulations and Enforcement Section headed by Denis Mulligan with O. D. Murphy chief of the Enforcement section. Sub-divisions of the Certificate and Inspection division include Air Line Inspection headed by J. B. Jaynes (interstate) and E. L. Yuravich (international), the General Inspection Service headed by Richard S. Boutelle; Aircraft Airworthiness, L. B. Kerber; Medical, Dr. R. E. Whitehead; Airways Inspection, Harry Agerter and Link Trainer Service, Ward Davis.

A board consisting of the Director, Assistant Director, heads of the seven divisions, with the technical assistant as secretary will be established to deal with matters affecting Bureau policies. An advisory committee of the whole Bureau, composed of civilian and other representatives of all aviation interests within the country also will be established.

### Trans-Ocean Flight

Dick Merrill became the first pilot to accomplish two round trip flights over the Atlantic Ocean when he and John Lambie landed at Floyd Bennett Field May 14 after a 24 hr. 22 min. flight from Southampton, England.

Merrill and Lambie had taken off from Floyd Bennett Field on May 9 and had flown their twin-engined Lockheed *Electra* to Croydon, England after making a stop at Northweald, Essex to check their bearings. The 3500-mile west-east trip was completed in 20 hours 59 minutes, Merrill having negotiated with news agencies to pick up photographs of the coronation.

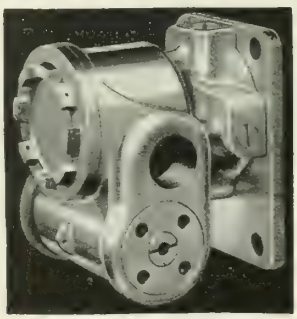
The return flight was interrupted by a landing at the Squantum Naval Air Station in Quincy, Mass. to enable the pilots to check their fuel supply, but after a 20-minute delay, the trip was resumed.

The *Daily Express* was powered by 550 hp P & W Wasp engines and carried a complete radio installation of Western Electric equipment. Additional fuel tanks of the Breeze type were installed in the passenger compartment to provide sufficient fuel for the long flight. There were 7 tanks in the cabin and 6 in the wing center section, giving a total capacity of 1270 gallons.

### Plant Expansion

Removal to larger quarters, providing 50,000 sq. ft. of space and enabling a production schedule of three ships daily, has been announced by Ed Porterfield, president of Porterfield Aircraft Corp.


SEVERE TESTS PROVE



EVANS *Aircraft* FUEL PUMPS

**Precision testing at the factory—practical trials under all flying conditions—prove the reliability of Evans Aircraft Fuel Pumps. This finely engineered fuel pump is compact, light in weight and perfect in every detail of material and construction. It incorporates the latest engineering development and is used today in leading makes of transport, private, coast guard and government aircraft. Write or wire for full information.**

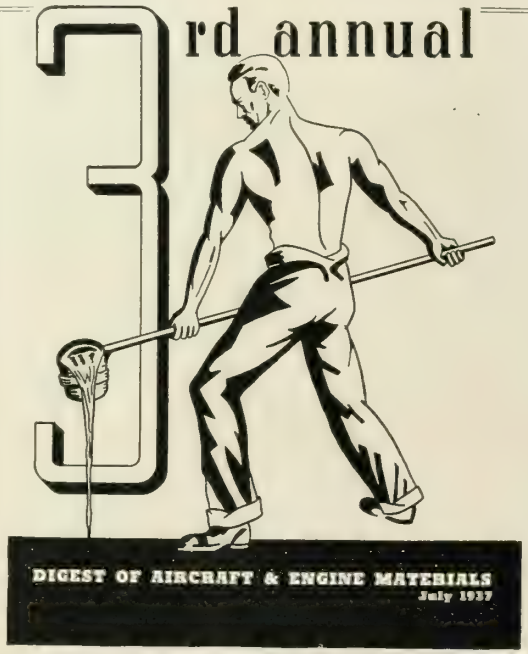
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ADVERTISING FORMS CLOSE JUNE 17TH

The new building is at 18th and Wabash Sts., Kansas City. Additional equipment will be purchased, including new and expanded paint-shop facilities. Executive offices will be housed on the second floor of the building which will also accommodate the engineering personnel of Porterfield Aircraft Corp., and Porterfield Aircraft & Engineering Corp., the latter being concerned chiefly with the study and planning of military aircraft.

Porterfield recently purchased Richards Field, an area comprising 153 acres of level land in Kansas City which will be held for further development. Production of the Porterfield Model 90, Model 70 and *Zephyr* will not be interrupted by the removal of the factory.

### Reorganization

Formed to take over the business of Taylorcraft Aviation Co., Taylor-Young Airplane Corp. was organized to continue the manufacture of the two-place Taylorcraft in an expanded plant in Alliance, Ohio. William C. Young, executive vice-president stated that the new company will file with the SEC a registration statement covering 290,000 shares of common stock $1 par value, of which 115,000 shares will be publicly offered at three dollars a share.

C. G. Taylor heads the new company and will supervise design and engineering. Young will be executive vice-president; Frank L. Sullivan treasurer, and Stanley I. Vaughn, factory manager.

As of April 29, 1937, the Taylor company had on hand unfilled orders for 257 airplanes, and production for the year is estimated to reach 450 units. During the first full month of the company's operations in April, 17 planes were produced.

### $2,454,977 Exports

Value of American aeronautical products exported in February, 1937 was $2,454,977, according to the Bureau of Foreign and Domestic Commerce. Thirty-five planes valued at $1,218,940 (including 12 seaplanes) and 109 engines worth $747,611 were shipped abroad, as well as $487,524 worth of instruments and accessories. This compares with $1,161,224 exported the same month in 1936.

Most airplanes were shipped to Argentina which imported 8 seaplanes valued at $376,000 and 3 landplanes worth $17,086. Other countries importing American aircraft included Mexico (6), United Kingdom, China and the Philippines (2 each); Greece, Norway, Panama, British India, Netherlands India, Japan and the Union of South Africa (1 each). China also imported 46 engines valued at $401,260, while Japan purchased $75,304 worth of instruments and accessories, to lead in the respective groups.

(*Continued on following page*)

## Coming Events

First Salon International de Aeronautique Palais du Centaire, Belgium. Sponsored by Ministry of Transport and Belgium Aero Club. May 26-June 6

•

Seventh Annual National Air Carnival. Birmingham, Ala. Aero Club; Stedham Acker, general chairman. June 5-6

•

Indiana Air Tour. Indiana Pilots Association. June 14-20.

•

Air Show, Grenville, Ohio. Municipal Airport. June 16

•

Air Meet. Findlay, Ohio, Municipal Airport. In conjunction Golden Celebration of Gas and Oil. June 23.

•

Fifth Annual Air Show. Junior Chamber of Commerce. Marshall, Mich. Municipal Airport. June 26

Eighth Annual National Soaring Contest. Sponsored by Soaring Society of America. Elmira, N. Y. June 26-July 11

•

International Glider Competition. Aero Club of Germany. Wasserkuppe. July 4-18

•

Air Show. North Dakota NAA. Ludvig Tweton, chairman show committee. Minot, N. D. July 8-9

•

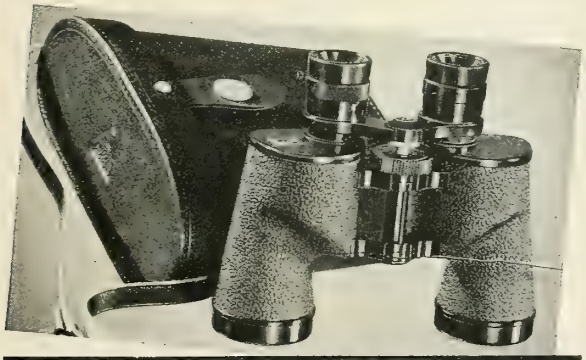
Fourth International Aviation Meeting. Zurich, Switzerland. Aero Club of Switzerland. July 23-Aug. 1

•

National Air Races. Municipal Airport, Cleveland, Ohio. Cliff Henderson, managing director. Sept. 3-6

•

SAE National Aircraft Production Meeting. Ambassador Hotel. Los Angeles, Calif. Oct 7-9

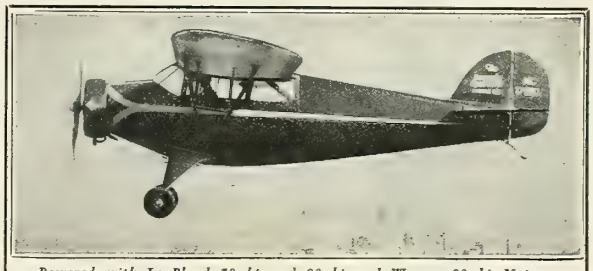
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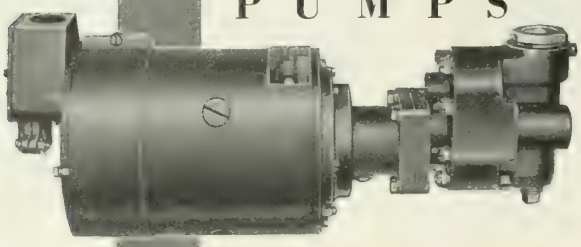
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# PESCO

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*(Continued from preceding page)*

### Dealerships

China Airmotive Co., New York and Shanghai; Fleetwings *Seabird* amphibion in China.

Brayton Flying Service, Lambert-St. Louis Field, St. Louis, Mo.; Ryan ST.

Russell Byer, Willshire, Ohio; Welch aircraft in northwestern Ohio and northeastern Indiana.

Dee Heistand and Nelson Straber, Anderson, Ind.; Welch aircraft in south and central Indiana.

Belle Fourche Sales & Equipment Co., Belle Fourche, S. Dak.; Welch aircraft in South Dakota, Wyoming, Nebraska.

### Foreign License

Canadian Car & Foundry, Ltd., Montreal, Canada has taken over the manufacturing rights to the Burnelli UB-14 twin-engined transport airplane, and are expected to prepare for its production in the near future. The Burnelli is adaptable for seaplane use being easily convertible for water operations and can be fitted out as a cargo carrier for operations in Canada where more freight is carried than in any other country.

### Thompson Buys Jadson

Acquisition of the assets and business of Jadson Motor Products Co., of Bell, Calif., has been announced by Fred C. Crawford, president of Thompson Products, Inc., Cleveland.

The plant in California gives Thompson advantages of complete manufacturing facilities on the Pacific Coast and is expected to improve service to replacement and original customers in the west. Jadson will continue manufacturing and sales activities under its own name and basic policies followed by both companies in the past will also be continued. Active managing personnel of Jadson remains unchanged with C. V. Dachetler acting manager and A. E. Robb, vice-president of engineering and sales.

## DIGEST OF RECENT EVENTS

**Speed Record for 5000 Kilometers Set by Rossi**

Capt. Maurice Rossi flew a bimotored low-wing Caudron monoplane 5000 kilometers at an average speed of 194.2 mph (312.5 kph) for a new world record. Flying the Istres-Toulouse-Bordeaux-Istres circuit first, Capt. Rossi subsequently changed to the Istres-Lyon-Istres circuit and completed his flight in 16 hrs. 3 min. 38 sec. to take the record from Comdr. D. W. Tomlinson and J. W. Bartles. The latter flew a twin-engined Douglas DC-1 at an average speed of 169.031 mph May 16-17, 1935 to set the old record. APRIL 25

**Australia-England Time Lowered By Broadbent**

Six days, 10 hrs. 55 min. after leaving Darwin, Australia, H. F. Broadbent landed at London, England to cut more than 24 hours from the old record established in 1935 by H. L. Brook. The pilot flew to England via Java, Singapore, Burma, Karachi, Iraq and Rome, to set the solo flight mark. Fastest time for the flight is credited to Cathcart Jones and Ken Waller whose record is 5 days. 15 hr. 23 min. MAY 3

**Pezzi Reaches 51,361 Feet and Sets New Record**

Squadron Leader F. R. D. Swain's altitude record of 49,944 ft. (15,223 m.) was broken when Col. Mario Pezzi, commander of the Military Altitude School, Montecarlo, Italy, flew to an indicated height of 51,361 ft. (15,655 m.). Col. Pezzi used a Caproni biplane powered by a 700 hp Piaggio engine. MAY 8

**Merrill and Lambie Fly Atlantic Both Ways**

Flying a Lockheed *Electra* powered by P & W Wasp engines, Dick Merrill and John Lambie landed at Croydon, England, May 10 after a 20 hr. 59 min. flight from Floyd Bennett Field, Brooklyn, N. Y. Eleven minutes earlier they had landed at Northweald, Essex to get bearings. A few days later, the pilots took off from Southampton for the return flight and finished the round-trip at their starting point 24 hrs. 22 min. later, or 5 days after the original take-off. On the return trip a landing was made at the Squantum Air Station in Massachusetts. MAY 14

**Boeing Bombers Make 1700-mile Non-Stop Flight**

Four Boeing YB-17 four-engined bombers from Langley Field, completed a 1700-mile nonstop formation flight over 18 east coast cities in a test maneuver. Powered by 1000 hp Wright Cyclone engines, the long-range planes completed the trip in 10 hrs. 35 min., after flying over Washington, New York, Hartford, Providence, Boston, Concord, Portland, Augusta, Montpelier, Albany, Syracuse, Rochester, Williamsport and Harrisburg. Lieut. Col. Robert Olds was in command of the flight. MAY 16

## FOREIGN NEWS IN BRIEF

### AUSTRALASIA

Guinea Airways Ltd. have inaugurated service between Adelaide and Darwin, using a Lockheed Electra and a tri-motor Ford. This is the first service to be operated in Australia by Guinea Airways, and the Ford is the first of its type to be seen in Australia.

New Zealand Air Force is to be augmented by three squadrons immediately, as part of an elaborate defense plan. Areas on the outskirts of Auckland have been completed, and it is possible that a new airport will be built rather than enlarging the present project at Hobsonville.

Choice of a suitable base for the new flying boats to be placed in service by Imperial Airways has not been decided. Representatives of the airline decided that Rose Bay was the most desirable area, but the Woollahra Council, which controls that site, will resist any steps taken to establish it as a base. Other possible sites have been inspected, but are regarded as unsuitable.

Nearly £200,000 is to be spent on the improvement of civil aviation facilities at airports on the east coast of Australia, while it is expected that approval for the installation of six Lorenz ultra-high frequency short wave radio beacons will be obtained shortly. Beacons will be erected at Brisbane, Sydney, Canberra, Holbrook, Melbourne, and Hobart, and each will operate over a 100-mile radius.

A new airline between Auckland and Wellington will be operated shortly by Union Airways, Ltd., subsidiary of Union Steamship Co. The company has ordered three 10-passenger Lockheed *Electras* powered by P & W Wasp engines.

Experimental service for passengers, mail and express between Penang and Hong Kong, which has been operated by Imperial Airways is to be continued. The operator will receive subsidy payments not to exceed $124,690 and eventually all first-class mail between Great Britain and Hong Kong will be carried by air.

The Empire air mail plan, whereby India will have five European mail services weekly, will become effective October 1, 1937. Two of the services will be operated by land planes, terminating at Calcutta and three will be made by seaplanes with Singapore as a terminus. The route between England and Karachi will be flown in 4 days at first, but it is hoped later, to reduce the time to 2½ days. Feeder service in India will be increased to meet the new schedules. Tata Sons, Ltd. will extend its services to Ceylon, and India Trans-Continental Airways, operating land planes between Karachi and Calcutta, is expected to purchase additional planes to coordinate its services with the new schedules.

### CANADA

Airplanes are selling in larger numbers in Canada this year, according to the deHavilland Co., at Toronto, which reports early in May the sale of 4 five-passenger *Dragon Rapides* to the Royal Canadian Mounted Police for patrol work on the Atlantic and Pacific coasts, and 20 trainers to the Royal Canadian Air Force. The company now has twice the number of orders that it had during the similar period last year.

The Department of Transport has appointed 4 new assistant inspectors to the Civil Aviation Branch, bringing the total of inspectors and assistants to 22. The new appointees are K. F. Saunders, who will be stationed at Rimouski on the St. Lawrence; Donald Saunders, F. M. Carter, and G. C. Upson.

Figures just released by the De-

*(Continued on following page)*

*The Italian Cant Z-508 flying boat, which set two altitude records, powered by Isotta Fraschini engines*




# A CARLOAD OF RYANS



We have just received and assembled a carload of high performance Ryan S-Ts. Enthusiastic acceptance here in the East is responsible for this wholesale order.

Pilots throughout the East have gone mildly mad over the most beautiful sport trainer ever offered at any price. Dealers have accepted it because they can expect real service from us. We expect to order another carload soon.

Distributors of RYAN & BEECHCRAFT airplanes, JACOBS and MENASCO motors, and STANAVO aviation products. We maintain station equipment for the repair of JACOBS and MENASCO motors. Our completely equipped repair shop is always ready to serve you.

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NORTH BEACH AIRPORT JACKSON HEIGHTS, N.Y.
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The finest Charter Service in America




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STINSON PLANE NEWS

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STINSON AIRCRAFT CORP.

WAYNE (Detroit Suburb) MICHIGAN

U. S. A.




*Czechoslovakian Beta-Minor BE-51 powered by a 90 hp engine*

(*Continued from preceding page*) partment of Transport show that Canada carried 1,159,834 lbs. of mail in 1936, a new record. This mail was carried on routes into regions served by no other mail transport, and a few intercity runs.

At the same time the Department reports that there were at the end of the year, 559 active private pilot licenses, 380 commercial pilot licenses, 65 limited commercial pilot licenses, 42 transport pilot licenses, and 533 air engineer certificates. There were 43 private planes, 402 commercial planes, and 98 airports.

Airplane clubs during 1936 had a membership of 2492 and used 66 planes; 645 members were under instruction. Club planes flew 17,324 hours and the 22 clubs trained 210 new private pilots and 34 commercial pilots, during the year.

Two new air mail routes were scheduled to start the end of May, the first from Prince George, B. C., to Takla Landing in northern British Columbia, and the second from Prince George to Fort Grahame, in the northeastern section of British Columbia. These will be monthly flights to new mining camps and fur posts.

James Lytell Memorial Trophy, emblemmatic of the flying championship of the Montreal Light Aeroplane Club was presented to Dean Nesbitt by Air Vice-Marshall W. A. Bishop, V.C. Second prize was presented to Don Thompson by Dr. D. B. Mowry, president of the club, and third prize to Alec Graydon.

An aviation section at Halifax is being created in the Royal Canadian Mounted Police. Four planes are already available, each manned by a pilot and observer. For some time the Mounted Police have been operating an air patrol on the Atlantic coast, but its personnel were officers and mechanics from the Royal Canadian Air Force. The new service will be administered and manned by the R. C. M. P. themselves.

A new flying service between Montreal and the northern Quebec mining fields, to be operated by Jack Moar to link this region with similar daily service to the mining areas of Ontario and Manitoba from Toronto and Winnipeg, is an expansion in operations of Skylines Express, Ltd., which is serving northern mining areas. Five new twin-engined airliners will be used. The planes, now being built by Fairchild Aircraft, Ltd., will cruise about 180 mph. and will be especially designed for service in the territory over which they are to fly. Standard equipment will include floats, in summer and skis for winter flying, with wheels also optional. The aircraft will be equipped with two-way radio.

Total income of Mackenzie Air Service, Ltd. in 1936 improved to $134,050 from $109,784 in 1935, and $118,734 in 1934. Expenses were lowered and net income transferred to earned surplus after deduction of income taxes amounted to $36,244 against $667 in 1935. Earnings equal 23.9 cents a share on the 151,500 shares of stock outstanding, before the recent public offering of 140,000 shares. On the basis of the 291,500 shares now outstanding, earnings would have equalled 12.4 cents a share. The company owns a joint interest in United Air Services, Ltd., along with Wings, Ltd. and General Airways, Ltd.

## CZECHOSLOVAKIA

Using a small oil-cracking device on a conventional 45 hp gasoline aircraft engine, kerosene was used as fuel on a successful 2-hour flight by the chief pilot of the Aero Club of Czechoslovakia at Prague. It is said any gasoline engine can be adapted to burn kerosene by the installation of the oil-cracking device which reduces mineral oil to a dry gas, and causes complete combustion without smoke or odor. Claims are made for considerable fuel economy.

The Walter *Super-Castor* has been approved by the Ministry of Public Works. It is an air-cooled, 9-cylinder, radial engine, rated 430 hp. at 2200 rpm., at 5742 ft. Weight is 782 lbs.

Negotiations for the operation of scheduled air service between Belgium and Czechoslovakia have been concluded. This service will reduce flying time between Brussels and Prague, (about 435 miles) to 3 hours, and will con-

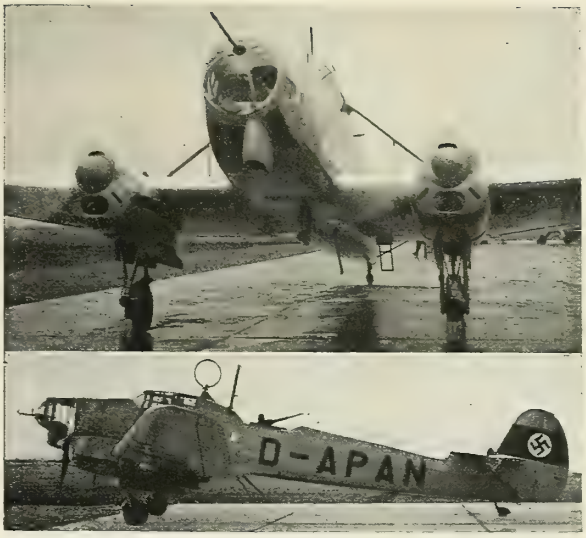
sist of one round-trip daily. Belgian Air Transportation Co. and Czechoslovak State Air Lines will operate the route jointly, and extend to the Balkans and the Near East at a later date.

### DENMARK

Civil aviation in Denmark is now administered by a Supervisor of Aviation, who reports direct to the Ministry of Public Works. His duties embrace inspection, maintenance, operation, regulation, licensing of aircraft and cooperation with foreign services. He also supervises the planning, mapping, marking, construction and maintenance of air routes and the direction of flying schools. Previously supervision was under an Aviation Council, consisting of flight and material inspection division, which reported to the Ministry of Public Works, but the Council now retains only its advisory duties.

### GREAT BRITAIN

Experiments are in progress with the liquid-cooled engine, specially designed for stratosphere flights, which will be installed in a counterpart of the Bristol monoplane that last September set an




*One of Germany's newest military craft, a Focke-Wulf bomber*

altitude record of 49,944 ft. (AERO DIGEST, November 1936). Since the record flight, the plane has been flown many times to 40,000 ft., and more, and actually attained a level above 50,000 ft., though another official attempt for a record must wait for more favorable weather in the late spring or early summer. Later in the year it will be joined by the second machine for a prolonged series of comparative tests of air-cooled and liquid-cooled engines in the stratosphere.

The record-holding plane has a double supercharged Pegasus air-cooled radial engine, designed to produce 400 hp. at 45,000 ft. and 330 hp. at 50,000 ft.

1937-38 estimates for civil aviation in the United Kingdom are about $11,330,000 or $2,716,000 greater than the 1936-37 estimated figures. A large portion of the increase will be used to carry out the Empire mail plan whereby first class mail will be flown throughout the Empire at domestic rates. During 1937 introductory services to certain parts of the Empire will be inaugurated as aircraft and airport equipment become available, and further use of the appropriation will involve experimental overseas flights, including those over the North Atlantic. For the base at Botwood, Newfoundland, $611,700 is provided, and funds for the construction of the flying boat base at Portsmouth are included. An initial appropriation of $483,400 for radio and control systems also is provided.

*Bombay* is the official service name of the Bristol Type 130 bomber-transport monoplane, which like the Bristol *Blenheim* high-performance medium bomber is to be manufactured in large numbers by an outside factory. Orders for the *Bombay* have been placed with the new firm, combining aircraft and shipping in-

(*Continued on following page*)

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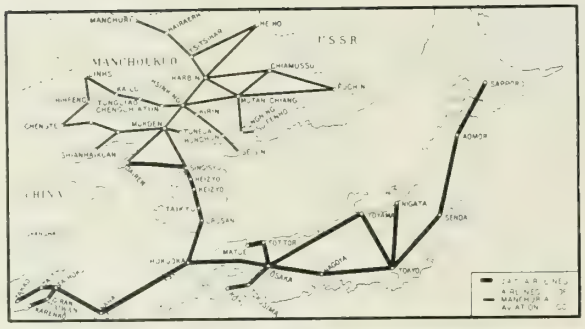
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terests, of Short and Harland, Belfast. The *Blenheim* is to be built at "shadow" factories under the government plan of providing a potential for large-scale war production outside the ranks of the aircraft industry. The "shadow" factories, most of which will be managed for the State by automobile manufacturers, are being established to build aircraft and engines in large numbers to help meet the present emergency; at the end of the Royal Air Force expansion programme they will be closed down, but kept fully equipped with tools and machinery against the demands of

## JAPAN

Service between Tokyo and Saipan will be inaugurated during this summer. The distance, 2562 miles, will be covered in about 36 hours and one round trip a week will be made during the first year.

Manchuria Air Navigation Co., Ltd. has superintended the construction of a new wood-and-metal low-wing monoplane for use on its airline routes. With a capacity for 5 passengers and one pilot, who is seated in an open cockpit, the plane is powered by a 480 hp. Nakajima Kotubuki 9-cylinder radial engine. Test flights indicate a maximum speed of 185 mph.






*Principal air line routes in Japan and a Japanese-made Beechcraft used by Japan Air Transport Co.*

As of November 1, 1936, there were 192 commercial landplanes and 28 seaplanes in Japan and at the same time the number of pilots, in all classes, totaled 781. In addition there were 296 navigators and 83 engineers registered.

## SOUTH AMERICA

Necessity of providing adequate and effective organizations in the various regions of Brazil has led the Director of Civil Aeronautics to create nine regional offices, to operate under the Division of Airports, to administer and aid projects in connection with airport construction and other matters. These offices will be in charge of representatives of the Department of Civil Aeronautics who will select airport locations, prepare budgets, etc. Airports of special significance, in the capitals of States, in large aviation centers and near the sea, will be constructed by or under the supervision of a special commission responsible to the Chief of the Division of Airports.

The Argentine Bureau of Civil Aeronautics has recently been authorized to spend approximately $65,323 for ten training planes to be manufactured at the aircraft factory in Cordoba. These planes are known as type AE. C-3 and it is understood that they will be powered by 145 hp. engines of American manufacture.

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# TRADE LITERATURE

### BEECHCRAFTS

An interesting booklet covering features of new Beechcraft models has been published by Beech Aircraft Corp. A series of candid camera shots show the care and attention devoted to the construction of fuselage, wings and other sections of the craft, and included in the data are a group of performance and specification tables as well as a description of new Beechcraft improvements incorporated in the latest models produced by the Wichita organization.

### PRESSES AND RIVETERS

Two new booklets have been issued by Hannifin Mfg. Co., each dealing with one phase of the company's line. *Hydraulic Presses* is contained in bulletin 40 and *Hy-Power Hydraulic Riveters* in bulletin 39.

The hydraulic units described in bulletin 40 are representative examples of equipment designed by Hannifin engineers as special types individually designed to simplify the operations required and to increase production. Both books are interesting inasmuch as they convey to the engineer and production superintendent what Hannifin makes available in stationary and portable hydraulic presses.

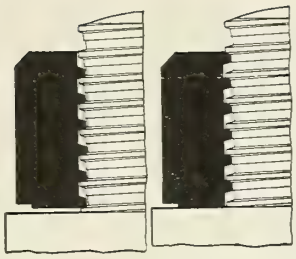
### LATHE MANUAL

The *Manual of Lathe Operation,* published recently by Atlas Press Co., is a 272-page book illustrating and describing latest technical data for machining new metals and plastics.

Chapters are included on lathe care and construction; theory of metal cutting; cutting tools, machining of various materials; holding the work; drilling and boring; thread cutting; lathe attachments and their uses; woodturning on the metal lathe; and machinists tables.

### SELF-LOCKING UNITS

Dardelet Threadlock Corp. has just issued Bulletin 16 which explains the principle of the Dardelet thread in a clear and concise manner. The four-page pamphlet discloses how the unit works, what it does and the various types marketed.



*Dardelet relieved thread in locked and unlocked position*

### BEARINGS

SKF has issued a new catalog *Aircraft Bearings* the data being published primarily for builders of aircraft. Bearings shown have been selected from the variety of sizes and types manufactured by SKF, as being particularly adapted to location on control systems where anti-friction bearings are more or less standard equipment.

Sketches and specification tables add to the value of the catalog as a guide to the use of these bearings.

### OIL CLEANING

Michiana Products Corp., has published *Perfect Oil Cleaning Job at Lower Cost,* a pamphlet describing the H-W and Michiana oil filter and the *Duo-Flo* filtering principle. A Duo-Flex element in which the filtering material *Wastex* is replaceable and another element which is sealed in a cartridge and replaceable as a unit, are illustrated. This is used as a replacement for the felt filter element of H-W filters and the other for use with a new model filter.

### METAL PROBLEMS

Although only a minor portion of *Strength Plus,* a new booklet describing the solution to scores of metal problems encountered by the engineer, is devoted to aviation, the publication serves a useful purpose and should make a valuable guide to Monel and other non-ferrous nickel alloys in various engineering applications.

Published by the International Nickel Co., the book contains 48 pages, illustrated throughout and is sub-divided into 20 units, each devoted to specific problems in various fields. Parts discussed are manifolds, wires, fittings, etc.

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(Continued from preceding page)

### FAFNIR CARTRIDGE

Plain bearing engines which are inefficient in operation or whose bearings have failed are easily converted to the ball bearing type with the Fafnir wide inner ring ball bearing motor cartridge, described in *Plain Bearing Motors Saved*, a new circular, issued by Fafnir Bearing Co.

The circular points out that motor users would like the advantages of ball bearings—elimination of wear, maintained air gap, foreign matter excluded from bearings, no oil leaks into the windings, and low labor cost for lubrication. By actual test, the company states, a group of plain bearing motors demanded 142 repairs, operating over the same period of time and under the same conditions as an equivalent group of ball bearing motors, on which only six repairs were required.

### TOOLS

*Haynes Stellite J-Metal Cutting Tools*, a 52-page booklet of interest to the user of machine tools, has just been published by Haynes Stellite Co. This booklet, with more than 60 illustrations, contains complete, detailed information on how to obtain maximum results in machining cast iron, malleable iron and most steels.

Among the important topics discussed are the recommended speeds and feeds for machining a variety of materials, methods of obtaining longer tool life, proper tool grinding practices, and points to check to insure maximum results on any machining operation. In addition, complete tables are included which indicate the conditions under which J-Metal is being operated on specific turning, facing, boring and milling jobs.

Supplementing this information is a section describing the proper procedures for grinding J-Metal tools. An extensive table of grinding wheels in this section enables quick wheel selection for any job.

* * *

Printed in the convenient pocket size, and containing 64 pages, Bonney Forge & Tool Works, has just issued Catalog No. 137 covering their line of hand tools.

One of the features of this book is the unusually large line of wrenches which has been developed for specialized applications.

# REVIEWS OF BOOKS

## SEAPLANES

By Daniel J. Brimm, Jr.

Accepted qualifications to write authoritatively on practically any subject include experience and a flair for imparting thorough knowledge of the topic under discussion. For these reasons *Seaplanes* is an excellent book, since Dan Brimm has been closely associated with seaplanes, flying boats and amphibions during the greater part of his 20 years in aviation, and his pedagogical work has given him the knack of writing intelligently and forcefully.

This book, published by Pitman Publishing Co., covers maneuvering, maintaining and operating seaplanes. It is, in fact, a most complete coverage of the subject, including as it does all details from construction of seaplane bases to the handling and flying of the ships that will use them.

Prepared as a guide for land pilots who wish to feel at ease on the water, for the seaplane student, for the commercial operator and for the private owner, *Seaplanes* fills a void in the published literature on a subject that is rapidly coming into its own.

## THE MODERN BOOK OF AEROPLANES

By W. H. McCormick

This volume tells the story of the development of the modern airplane and airship by the efforts of experimenters. It describes in simple language the manner in which an airplane is flown, and the various instruments upon which the pilot depends for guidance. Chapters are devoted to most famous flights that have been made during recent years and to air racing and record-breaking endeavors.

Primarily British, the book is practically an expose of the most recent British types with 46 illustrations from photographs furnishing sufficient evidence of the growth of aviation.

A chapter on aircraft and aircraft radio, particularly with regard to radio navigation of air transport planes is interesting, inasmuch as it reveals the methods used abroad and furnishes a basis of comparison with those used in this country.

## SKY STORMING YANKEE

By Clara Struder

The biography of Glenn Curtiss is an interesting and illuminating insight into the life of one of America's pioneers in aviation.

Historically accurate and well-written, Mrs. Struder's book is a valuable contribution to the knowledge of the background of early American aeronautics. Here, the reader will find the motives and struggles that made so reserved a man of Glenn Curtiss—and the author's tome provides a new understanding of the man. The sections devoted to the first flight of the *June Bug* and the equally-famous flight from Albany to New York are well done and show evidence of Mrs. Struder's long association with aviation dating back to her work with the Curtiss Corporation when, as Miss Trenckman she worked with Casey Jones and others in promoting the cause of aviation.

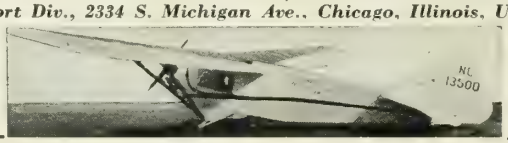
Included in the volume are some 30 pages of rare photographs, providing visual evidence of the life of Glenn Curtiss as he devoted it to aviation.


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## ALLISON ENGINE

(*Continued from page* 50)

reduction gear housing consists of 2 hollow tubular shafts which are concentric with each other. The inner shaft transmits the power torque of the engine while the other shaft takes care of the propeller bending loads.

Pistons are machined from aluminum alloy forgings and the underside of the piston heads are grid-ribbed to facilitate cooling; there are 1 oil and 3 compression rings to each cylinder. Connecting rods are chrome nickel molybdenum steel forgings of the forked and blade type machined and polished all over, 2 being mounted on each crankpin with a single split steel back bearing faced with lead bronze inside for crankpin bearing and outside for the blade rod bearing.

Accessory housing is a magnesium alloy casting mounted directly on the rear of the crankcase and contains the centrifugal supercharger and the drives for the coolant pump and camshafts, fuel pumps, vacuum pump, oil pump and generator. The supercharger impeller is 9.5″ in diameter and is driven at 6.75 times crankshaft speed, high supercharger efficiency being obtained by 6 curved vanes in the diffuser passage. Supercharger impeller shaft is supported on 2 lead bronze steel back floating bearings and the supercharger, like the camshaft, is driven from the reduction gear by the long flexible shaft, thus obviating the necessity of clutches usually required to take care of the effects of rapid changes of speed of the crankshaft.

A single Bendix Stromberg 4-barrel down draft carburetor with automatic mixture control mounted on the rear of the accessory housing supplies the fuel-air mixture to the supercharger which delivers the mixture to the ramming type manifolds which contain grids to prevent backfire flames from reaching the supercharger.

Ignition is supplied by one fixed timing high tension Scintilla double magneto, current being distributed to the spark plugs through 2 separate camshaft driven high tension distributors. Two BG spark plugs are used for each cylinder. When the engine is enclosed in a tight cowl, a blast of cooling air for the exhaust plugs is supplied by a light aluminum alloy manifold.

Chemically-cooled V-type engines not only lend themselves to the installation of an exhaust driven turbo supercharger but also permit locating radiator equipment on the plane where minimum drag is experienced.

The Air Corps Power Plant Section at Wright Field has purchased a number of these engines and carried through testing of different designs that led to the accompanying engine specifications. In addition to the test work carried on in the engine laboratories, Wright Field installed a test

engine in an experimental airplane which to date has flown more than 100 hours. The absolute ceiling reached by this plane (which is not equipped with turbo supercharging) was 26,400 ft. made by Lieut. B. S. Kelsey of the Flight Section, Wright Field.

With magneto, carburetor, coolant pumps and pipe, exhaust stack flanges, tachometer, generator, fuel and vacuum pump and drives and provision for hydro or electric controllable pitch propellers, the Allison 1710 engine weighs 1280 lbs., or 1.28 lbs./hp. Other specifications are as follows:

| | |
|---|---|
| Bore | 5.5 inches |
| Stroke | 6 inches |
| Displacement | 1710 cubic inches |
| Overall height | 40.94 inches |
| Overall width | 28.94 inches |
| Compression ratio | 6:1 |
| Blower ratio | 6.75:1 |
| Propeller shaft ratio | 2:1 |
| Normal and take-off power | 1000 |

## PAN AMERICAN AIRWAYS

(*Continued from page* 21)

is required for advancement. Aerodynamics, engine theory, meteorology, navigation, are important. But there are such subjects as maritime regulations, foreign languages, international law, basic science, engineering and mathematics. Along each route the pilot is expected to familiarize himself with the culture, the background and the characteristics of the nationalities with which he will come in contact. Woven through the entire program is the development of executive ability as the pilot progresses toward the position of Captain.

Each pilot's career is featured by a step-by-step assignment to graduated tasks. Apprentices serve most of their time in the Caribbean, shift to the Pacific for a tour of duty as Junior Officers. Then they return to the Caribbean, to the coastal routes of South America, or to the Western Division, to qualify for command of ships of all speeds and sizes. Finally they go once more to the four-engined ships as First Officers, then as Captains. It is perhaps 8 to 10 years from Apprentice Pilot to Master. But once in that position a pilot's career is as permanent as that of the Captain of an ocean liner. On the present Clippers the Captain spends much of his "on duty" time at one set of the ship's controls. With Clippers now under construction the Captain's main station will be at a desk in his own cabin-office.

This brings us to the most obvious limitation to date of the Pacific service—the size of the Clippers. It certainly is no matter of reproach to the designers and manufacturers. Both the Martins and Sikorskys substantially exceeded the airline's initial specifications. Both have useful load-gross load ratios of approximately

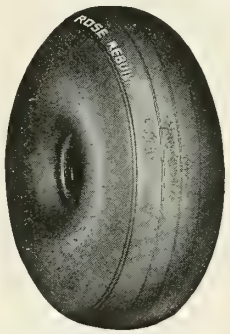
(*Continued on following page*)


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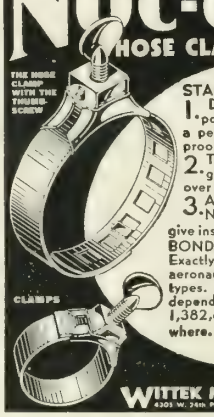
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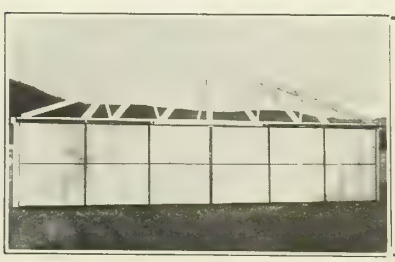
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*(Continued from preceding page)*

50%. The Martins with 52,000 pounds gross load capacity are still the largest airplanes ever operated in commercial service. Through the past year of tight-schedule operations they have proven practical from a maintenance point of view.

But 52,000 pound ships aren't anywhere near the ultimate for such non-stop flight assignments as 2400 or 2000 miles. Carrying great reserves of fuel, elaborate emergency gear, and large weights per passenger in seats, berths, soundproofing, galley, etc., they cannot furnish as much traffic capacity as is desired.

It would be impossible to predict to what sizes flying boats will go eventually. It is easier to answer how big they will be for the beginning of passenger operations over the Atlantic next year—Boeing is already building a fleet of six super-Clippers (see page 51 of this issue) for that purpose which should have their first test flights early this Fall.

## NACA CONFERENCE

*(Continued from page 23)*

compressibility burble first becomes apparent.

The Atmospheric (7′ × 10′) Tunnel in its new form has been devoted to the study of improved lateral control devices. A demonstration was given of sealed gap ordinary type ailerons. It was shown how the normal linkage without the differential effect results in abnormally high stick loads. The ordinary type of differential motion, although an improvement, is only a fraction of what can be accomplished when the ailerons are equipped with drooping tabs. The effect of the tabs is explained by the increased tendency of the upturned aileron to trail considerably higher than in the case of a conventional aileron.

### New Free-Flight Tunnel

The NACA's new Free Flight Tunnel is a remarkable piece of equipment. Its potentialities are as great as those of the free-spinning tunnel or any other tunnel in the world. It is difficult to estimate the range of its application, but it should definitely provide unique means of research for stability, control and motion of an airplane in free flight and others not immediately apparent.

The new tunnel, made pivotal around a horizontal axis, is provided with a landing platform inside its working portion. A small model, dynamically similar to the actual airplane, is on the landing platform resting on its landing gear. When the tunnel is started and its speed brought up to the magnitude required for flight, the model takes off and flies within the working portion. The tilt of tunnel provides the necessary path angle and the model floats before the observer in a steady glide attitude. The model is equipped with control surfaces which are

operated from the outside by the usual type of surface controls, electrically-operated.

The vast amount of work performed by the Committee during this year and the degree of importance of its contributions speak for themselves. To anyone who knows the busy schedule of the work which the Laboratories must accept from the industry to aid its engineering progress these accomplishments become even more impressive.

---

The conference was held on two days, the 18th and 20th, the first day being attended by the engineering members of the industry. In addition to Bureau of Air Commerce, NACA, Army and Navy officials, press representatives (including AERO DIGEST), among those attending the initial session were:

*Aeron'l Corp. of America:* R. E. Schlemmer. *Aeron'l Chamber of Comm.:* W. C. Clayton, C. E. Parker, L. W. Rogers. *Air Transport Assn. of Amer.:* F. W. Barker. *Allison Engineering Co.:* H. J. Buttner, R. M. Hazen, O. T. Kreusser, C. J. McDowall. *Argonaut Aircraft, Inc.:* H. J. Heindell, M. Treman. *Arrow Aircraft Corp.:* C. F. Biesemeier. *Aviation Mfg. Corp.:* V. Cronstedt. *Beech Aircraft Corp.:* O. L. Davis. *Bendix Products Corp.:* R. Hurley, J. M. Miller, F. C. Mock. *Bell Aircraft Corp.:* L. D. Bell, H. M. Poyer, R. J. Woods. *Bellanca Aircraft Corp.:* G. M. Bellanca, A. F. Haiduck, R. D. Morgan. *Boston & Maine Airways:* S. J. Solomon. *Breeze Corp., Inc.:* J. J. Mascuch. *Brewster Aeron'l Corp.:* D. T. Brown, F. S. Hubbard. *Boeing Aircraft Co.:* J. P. Murray. *Chance Vought Aircraft:* R. B. Beisel, C. J. McCarthy, J. M. Shoemaker, R. Vought, P. S. Baker, E. E. Wilson. *Cleveland Pneumatic Tool Co.:* E. W. Cleveland, L. W. Greve, J. F. Wallace. *Consolidated Aircraft Corp.:* E. N. Gott, I. M. Laddon, H. E. Weihmiller. *Continental Motors Corp.:* J. B. Bornasero, N. N. Tilley, W. R. Angell, F. T. Gould. *Cunningham-Hall Aircraft Corp.:* R. F. Hall. *Curtiss-Wright Corp.:* R. L. Earle, B. G. Eaton, C. W. France, P. Hovgard, A. I. Lodwick, T. A. Morgan, G. A. Page, G. C. Rogers, C. W. Scott, W. E. Valk, T. P. Wright, B. S. Wright, G. W. Vaughan. *Douglas Aircraft Co.:* F. R. Collbohm, A. L. Klein, J. M. Rogers, H. Wetzel. *duPont de Nemours Co.:* L. Copeland, A. F. duPont, Jr., C. L. Petze, Jr. *Eclipse Aviation Corp.:* J. W. Allen, D. Gregg, C. H. Havill, A. E. Raabe, Z. Soucek. *Edo Aircraft Corp.:* B. V. Korvin-Kroukovsky, E. D. Osborn. *Elastic Stop Nut Corp.:* H. H. Powell, A. Swanstron, H. B. Thomas. *Electrical Research Products:* H. I. Day. *Engineering & Research Corp.:* F. Levy, H. Lewis, R. Sanders, F. E. Weick. *Fairchild Aircraft Corp.:* G. Allward, V. E. Clark, G. W. DeBell, L. Fahnstock, J. H. Jouett, A. Thieblot, D. B. Cox, R. H. Depew, S. M. Fairchild, B. Havens, G. Hardman. *Fleetwings, Inc.:* C. deGanahl, R. Miller, W. L. Sutton. *Grand Canyon Airways:* G. E. Reichstell. *Grumman Aircraft Engineering Corp.:* B. A. Gillies, L. R. Grumman, W. T. Schwendler, C. Tilgner, G. F. Titterton. *Gwinn Aircar Co.:* J. M. Gwinn, Jr. *Hall-Aluminum Aircraft Corp.:* A. M. Hall, C. F. Pape. *Hamilton Standard Propellers:* F. W. Caldwell, C. F. Schory, Erle Martin, R. Walsh, S. A. Stewart. *Hughes Aircraft Co.:* B. B. Masterson, G. E. Odekirk, R. W. Palmer. *Jacobs Aircraft Engine Co.:* A. R. Jacobs, H. M. McFadgen. *Kellett Autogiro Corp.:* H. L. Mulvey, R. H. Prewitt, W. V. Trelease. *Kinner Airplane & Motor Corp.:*

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At the time of going to press no list of those who attended the Thursday session was available.

### UNITED RADIO NETWORK

(*Continued from page* 40)

built, new radio equipment for these ships is being tested.

Another function of the laboratory is the grinding of quartz crystals for use in the frequency control units of the transmitters and receivers. A skilled lapidary works constantly, making new crystals and maintaining the old. All United crystals are now cut on the "A" axis, in a diagonal plane through the grain of the quartz, and are stable as to frequency through a wide temperature range, making crystal heater units unnecessary. Polarized light is used for periodical crystal inspection, and the history of each crystal is recorded on a "log card."

New problems presented by high-speed and high altitude operation are finding practical solutions. For research into the little-known realm of electrical phenomena affecting aircraft radio operation, United maintains a completely equipped flying radio laboratory—a stock model 247-D Boeing transport fitted with numerous devices for producing, measuring and recording these phenomena.

## STEEL PROPELLER

(*Continued from page 35*)

### Vibration and Whirl Tests

When considering vibration characteristics, a point in favor of aluminum alloy is its greater internal damping. Favoring heat-treated steel is its greater fatigue limit, namely 60,000 lbs./sq. in. as compared with 12,000-14,000 lbs./sq. in. for aluminum alloy. The solid steel propeller with the c.g. at about 35% of the chord also has in its favor greater stability in torsion. While propeller flutter is less to be feared than resonant vibration due to engine impulses, this torsional stability is a valuable safety element.

Fifty-hour ground engine endurance tests and 200-hour service flights tests on a 300 hp engine at Wright Field and in actual service have given evidence of durability and smoothness. The 9 ft. 2-bladed propeller, designed for 300 hp at 2000 rpm passed a whirl test at Wright Field when absorbing 893 hp at 2603 rpm with an overload of nearly 200%. In addition, a 12-ft. three bladed propeller during the whirl test absorbed 1869 hp at 1400 rpm at optimum angle.

Too great rigidity in bending of a propeller blade eliminates resonant frequencies, but on the other hand may induce too great a concentration of stress at the hub. The solid steel propeller seems to achieve the correct compromise between extreme rigidity and excessive flexibility. Thus Wright Field has tested this type of propeller by its method of artificially induced vibrations with such satisfactory results that the 1936 and 1937 Air Corps primary training planes are being equipped solely with solid steel propellers.

### Blade Manufacture

McCauley production has been advanced by the cooperation of Ladish Drop Forge Co. which has made considerable research in forging steel propeller blades, developing appropriate alloys and methods of quantity production. In manufacture the forgings are made close to actual dimensions and then machined in a Rockford automatic planer-duplicator, a new unit manufactured by the Rockford Machine Tool Co.

### Detachable and Adjustable Blades

The McCauley propeller is constructed with detachable blades and pitch may be adjusted on the ground. The fixed pitch hub is made in halves to allow better forging of the material, and to provide strength combined with weight saving. Hub construction is such that each blade may be taken out separately without disassembly of the unit, sockets providing positive centering. Blades are held in place by threaded collars against a solid base within the hub, integrating hub and

(*Continued on following page*)


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| P & W | A-1 R1690 Radial "Hornet" | 9 | 525 | 1900 | Air |
| Wright | R975 Radial "J-6" | 9 | 300 | 2000 | Air |
| Wright | R790 Radial "J-5" | 9 | 225 | 2000 | Air |
| Curtiss | V1150 "D-12" | 12 | 435 | 2300 | Liquid |
| Curtiss | V1570 "Conqueror," Direct Drive | 12 | 600 | 2400 | Liquid |
| Curtiss | V1570 Geared "Conqueror" | 12 | 600 | 2400 | Liquid |

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| REARWIN: Seaplane | 2,145 |
| STINSON: 1933 model | 2,600 |
| TRAVEL AIR: J6-5, Model 4000 | 1,095 |
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| WACO: 1934 model, seaplane | 5,195 |

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*(Continued from preceding page)*

blades into a unit. The solid blade is equally well adapted for use in controllable hubs.

#### Maintenance, Inspection and Repair

At times it is necessary to etch aluminum alloy blades for inspection, with some loss of material, which is undesirable, however trifling. In the solid steel blade no etching is required, since the Magnaflux method of inspection can be used.

A Wright Field engineering memorandum states that in straightening out a bent solid steel blade, the angle of bend should be limited to a maximum of 30°, and that the blade should not be straightened more than twice, adding also that "the McCauley solid steel blade can be easily straightened cold for a limited amount of bending."

#### Conclusions and Possibilities

While it is doubted that solid steel will replace the aluminum alloy propeller, manufacture of the McCauley propeller is relatively simple and likely to be so inexpensive that more solid steel propellers will be used in moderate priced private airplanes.

As engines increase in power and planes in speed, there will be greater stresses to take up, and the use of high strength steel alloys will then become of even greater interest. Also as engine powers increase, and diameters are expanded, there may be recourse again to steel alloys, with appropriate thickening near the hub.

Inasmuch as the speed of aircraft and propeller tips will increase with operations confined to the sub-stratosphere, thinner profiles both for aircraft wing and for the propeller will become of greater necessity. The development of solid steel propellers in larger sizes is of general interest. At present the McCauley Co. is building a three bladed 13 ft. propeller, and is designing a 16 ft. prop for eventual use on a 2000 hp engine.


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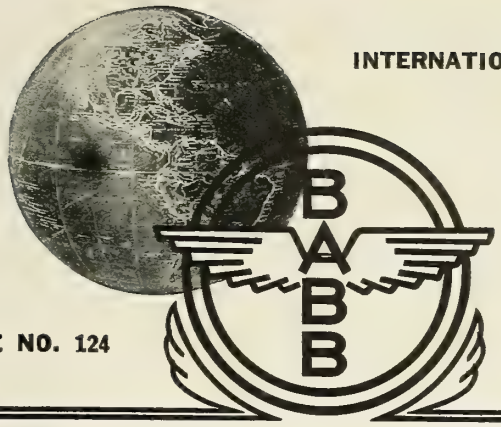
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AEROMARINE KLEMM: LeBlond 65; motor majored 50 hours back. Has brakes, full airwheels, navigation lights; never been cracked. $600 or trade. AERO DIGEST, Box 2619.

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LOW WING: LeBlond powered, under 150 honest hours since new. Extra equipment: special instrument panel; large bank and turn, rate of climb, and clock; flap; navigation lights, battery; complete wiring including mounts for landing lights. Cost new $3,095 at factory as equipped, priced now at $1,995. Ship and engine in perfect condition as majority of usage was demonstration. Basil Aviation Co., Somerton Airport, Philadelphia, Pa.

AERONCA C-3 MASTER: Like new in every respect, new July 1936. Extras: door, dual throttles, cabin heater, oversize tires, wiring for lights. Priced for quick sale. Slim Soule, Wyoming Valley Airport, Forty Fort, Pennsylvania.

SEAPLANE AERONCA C-3: Just completely corrosion proofed, with petrolatum and beeswax; Lionoil inside all longerons and throughout wings. 1936 floats. Stainless steel tie rods. Completely recovered. Like new, must be sold at once. Small deposit necessary to hold. Write, phone or wire J. A. Wales, Jr., 230 Park Avenue, New York, N. Y.

AERONCA's: All models available at Pioneer Aero Brokerage, Syracuse, New York. We buy, sell, brokerage, finance, all type airplanes. Write for details on model you want.

AERONCA C-3: Excellent condition and covering nearly new; $500. V-AG9-D shielded mags; overhauled, $20 each. Eclipse generator, model 2162, $30. Warner steel prop hub H-5170, $15. 30 x 5 wheels and brakes, $20 pair. 22 x 10 air wheels, tires, tubes and brakes, $45; 24 x 4 wheels, tires and tubes, like new, $20 pair. 2260 Edo floats. N. B. Rich Co., Boston Airport, Boston, Mass.

AERONCA: Low wing; 85 LeBlond; total time on airplane 125 hours; new engine; perfect condition throughout. Finance 50%. John T. Corrodi, Inc., Box 185, Bexley Station, Columbus, Ohio.

AERONCA C-3: 1935; round fuselage model. 600 hours; bright yellow color; never damaged. Heater, excellent fabric. Licensed September 1937. Price $975. Air Activities Airport, West Chicago, Illinois.

FOR SALE: Aeronca C-3 in very good condition. Ship located at Teterboro Airport. Navigation lights. $600. John Thomson, 302 Cleveland Avenue, Hasbrouck Heights, New Jersey.

AERONCA C-3: Late '34. 20 hours since factory major on motor. Enclosure, heater. Must sell at once. Sacrifice, $695. Can finance. Leeward Flying Service, New Kensington, Pennsylvania.

AERONCA C-3: Just recovered and majored; excellent condition; a late '33. E-113 motor; $550 will get this ship; a real bargain. No terms. Glass, Hangar 9, Love Field, Dallas, Texas.

LATE '36 AERONCA C-3: Privately owned; 70 hours total; compass and heater; $975. New English Mark II Cirrus engine, $200. Tred Avon Flying Service, Easton, Maryland.

### *American Eagle*

FOR SALE OR TRADE: Ground trainer, Henderson powered and Heath prop. Maneuvers on land and may hop. Sell or trade for outboard motorboat. Write for details. Joseph Calcagni, 2527 Hughes Avenue, Bronx, New York.

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### *Aristocrat*

ARISTOCRAT: Recently recovered, less motor and prop, $350. Fred Vilsmeier. H and Luzerne Streets, Philadelphia, Pennsylvania.

ARISTOCRAT: 3-place cabin, Warner 125; both motor and plane newly reconditioned. Will be relicensed in July. Cash price, $965. No OX trades. Brittain Motor Co., 316 Washington Street East, Stroudsburg, Pennsylvania.

### *Arrow*

ARROW SPORT: LeBlond 65 engine, just majored. Plane just relicensed. Airwheels, speed ring, high gloss blue and cream paint job; steel prop. $695. J. Willard Miller, Cub Distributor, Lock Haven, Pennsylvania.

1937 DE LUXE ARROW V-8 low wing: 40 hours since new. Factory cost, $1,665; sacrifice, $1,250 cash. Never cracked; condition perfect. H. Carl McQuigg, Lewistown Airport, Lewistown, Pennsylvania. Phone: 9220.

### *Bellanca*

BELLANCA: With 330 Wright. Ship recently recovered and engine modernized. Ideal ship for photography and a real bargain. Wings Field, Inc., Ambler, Pennsylvania.

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BEECHCRAFT B-17-L: Jacobs L-4, 225 hp. 337 hours since overhaul; total time engine 629, airplane 581 hours. Basic instruments plus bank and turn indicator, rate of climb indicator, Sperry directional gyro, Pioneer compass, RCA radio receiver and clock. $2,700 cash. Standard Oil Hangar, Newark Metropolitan Airport, Newark, New Jersey.

1936 BEECHCRAFT: 225 hp. Jacobs motor; pleasing green color; very complete instruments; RCA radio. Total time 195 hours. $6,950. Privately owned. AERO DIGEST, Box 2628.

### Bird

BIRD: Four-place. Best Bird in country today. Starter, brakes, complete set instruments, late engine; perfect conlition. Max Rappaport, Roosevelt Field, Mineola, New York.

KINNER BIRD: Steel prop, semi-airwheels, brakes, oleo landing gear; covering good; licensed to March '38. Motor majored 25 hours ago. Price, $1,145. Walter C. Hartman, 429 Edgemont Street, Mt. Washington, Pittsburgh, Pennsylvania.

BIRD, B-5 KINNER: 4-place. Just relicensed; airwheels, steel propeller and brakes. $1,450. Will take trades. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

BIRD, KINNER K-5: 758 hours plane, motor 226 hours. Topped at 206 hours. High gloss finish. Full airwheels. Oleo landing gear, duals, standard instruments; licensed to November. $950. Harold W. Pugh, Municipal Airport, Burlington, Vermont.

KINNER BIRD: K-5 front exhaust. 60 hours since major. Beautiful all yellow finish. Oleo gear, airwheels, duals; just relicensed. $1,495. Can finance. Leeward Flying Service, New Kensington, Pennsylvania.

KINNER B-5 3-place Bird: Ship just recovered and majored; collector ring, steel prop, brakes, landing lights, complete set instruments, Heywood starter. Reasonable. AERO DIGEST, Box 2637.

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BUHL TRAINER: 2-place, licensed. Less engine. $300. Or can supply engine and propeller. E. M. Laird Airplane Company, 5917 S. Cicero Avenue, Chicago, Illinois.

BUHL PUP: Szekely; 350 hours. Motor 10 hours since major; heavy duty crankcase and crankshaft, steel barrels. Partly modernized. Just licensed. $450. H. W. Pugh, Municipal Airport, Burlington, Vermont.

### Butler

J-5 BUTLER BLACK HAWK: 3-place open biplane. Completely recovered, gloss finish, air wheels, motor overhauled. Excellent condition throughout. Just relicensed. $1,075. Carthage Airways, Carthage, Missouri.

### Cessna

WARNER CESSNA: Licensed till October 1937. Blind flying instruments. Radio, speed ring, semi-airwheels, tail wheel, late ailerons. $850. Buck, 409 N. Francis, Madison, Wisconsin.

CESSNA: 4-place; powered with Siemens-Halske engine, 128 hp. Standard instruments, airwheels and brakes. Ship in A-1 condition. Price, $695. William Miller, Hangar 3, Floyd Bennett Field, Brooklyn, N. Y. Phone: NIghtingale 4-4200.

CESSNA: All models available at Pioneer Aero Brokerage, Syracuse, New York. We buy, sell, brokerage, finance all type airplanes. Write for details on model you want.

CESSNA: 250 hp; excellent altitude ship for mapping or weather flying. Priced to sell. Terms to responsible buyers. Edw. A. Forner, Jackson, Mich.

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125 HP WARNER Command-Aire: 3POLB. Recently topped and new paint job. Licensed. Hamilton steel prop. $700. H. R. Gustin, Pine City, New York.

CHALLENGER COMMAND-AIRE: Licensed; total time 570 hours. Steel prop, speed ring, air wheels and brakes. $850. Louisville Flying Service, Inc., Louisville, Kentucky.

### Cub

TAYLOR CUB: Late '35 engine just majored. Ship in wonderful shape. Wings Field, Inc., Ambler, Pennsylvania.

1935 TAYLOR CUB: 525 hours. Licensed to October 15, 1937. Ship in very good condition. Would trade on 3-place open ship. $750. Serv-Air, Inc., Box 1118, Raleigh, North Carolina.

1935 CONTINENTAL CUB: 117 total hours since new. Privately owned and operated. Enclosure; compass. Excellent condition throughout. $875 cash. George M. Foltete, Holmes Airport, Jackson Heights, New York.

$890 CUB: Like new; winter enclosures; covered with Grade A "Flightex" and Berry Bros. paint. Consider auto, diamond. J. E. Blythe, 1108 East Admiral, Tulsa, Oklahoma.

CUB BARGAIN: Dual ignition; yellow paint; enclosure, carburetor heater. Manufactured February 1937; less than 100 hours time. Cash, $1,240; no trade-ins. Jesse Jones Air Service, Lancaster, Pennsylvania.

TAYLOR CUB: 1935 model. 40 hours since complete major on ship and engine. Exceptionally clean throughout. $795. $395 down and $42 a month for 12 months. Will take trades. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

TAYLOR CUB: Brand new. Undelivered. Will trade desirable automobile and finance balance. I. Walter Sell, 566 Vine Street, Johnstown, Pa.

CUB J-2: Continental A-40-4, like new; compass, ball bank. Will consider trade on 3-place Travel Air sport trainer or Waco F. Box 464, Hempstead, L. I., New York.

CUB: BUILT just before fire; 20 hours time, special paint job; dual ignition, roller bearing wheels, bucket seats, Kollsman altimeter and compass, ball bank, carburetor heater, steerable tailwheel; new ship guarantee. $1,300 cash. Fairhaven Airport, Fairhaven, Massachusetts.

CUB: LATEST model, condition excellent; carburetor heater, air speed and enclosure; must sell. Best offer takes ship. Phil Miraglia, 203 Irvington Drive, Tonawanda, New York.

'36 CUB, J-2 MODEL: A-40-4 engine; less than 60 hours total; plane guaranteed like new. $1,050. Lytle, 2333 Vodeli Street, Pittsburgh, Pennsylvania.

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TWO J-2 '36 CUBS: Less than 200 hours total time. Exhaust collector heater. $900 and $975. Akron Airways, Airport, Akron, Ohio.

1937 TAYLOR CUB: Two months old; large tires; blue and yellow. Can finance. Special at $1,100. AERO DIGEST, Box 2636.

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OX-5 ROBIN: New covers, pyralin, Millerized, 30 x 5 wheels, oleo landing gear; extra good performance; licensed April 15, 1938. $525. Frank Knauf, Punxsutawney-Braebreeze Airport, Marchand, Pennsylvania.

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CHALLENGER ROBIN: New covering, new upholstery; motor recently majored. Starter, extras. $850. NC986-K. Photographic ship; 16,000 feet guaranteed. Monty Barnes, 638 Pattie, Wichita, Kan.

OX-5 ROBIN: Licensed; Millerized motor. Completely rebuilt at $400 cost. Will take late model car in trade. Vernon Miserez, West Point, Neb.

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FOR SALE: 1931 Curtiss-Wright Jr. airplane. Ship completely overhauled and recovered June 1936; both ship and motor in first class shape. Licensed to October 1937. Leonard A. Nelson, 820 N. Second Street, Ishpeming, Michigan.

CURTISS-WRIGHT JUNIOR: Licensed September 1937. Excellent condition, 50 hours since major. Airspeed, altimeter, bank. Price, $350. Eugene McCormick, 1620 Arapahoe, Denver, Colorado.

JUNIOR: Excellent condition; will relicensed prior to sale for $395. 65 hours since rebuilt and majored at Approved Air Repair Station. Aluminum crankcases, extra prop. R. J. Crowley, Dickinson, N. D.

### Driggs

$300 DOWN BUYS latest model Driggs Skylark, powered with Rover motor. Just majored. Fabric excellent. Accept cash or trade and finance balance. Central Air Service, Inc., Grand Rapids, Michigan.

### Davis

DAVIS: 65 or 90 LeBlond. Pants and a lot of extras. Motor just majored. Airplane like new. $750. Private party. Loyd Adkins, Stinson Airport, LaGrange, Illinois.

### Eaglerock

HISSO EAGLEROCK: Very good condition. Licensed to September 1937; new motor, airwheels and brakes. Will take automobile in trade. Russell Ahrens, 47 School St., Liberty, N. Y.

EAGLEROCK A-2: Recovered year ago; licensed November 1937. OX-5 partly Millerized. Big wheels, $375. OX-5 motor, overhauled, $35. Gus Imm, 884 Cherokee Avenue, St. Paul, Minnesota.

LONGWING EAGLEROCK: All parts for sale. Also good OX and many overhead parts. Write to D. R. Dorn, 125 Maple Avenue, Wellsville, N. Y.

BEST OFFER OVER $300 takes OX-5 Model A-1 Eaglerock. This ship stressed for Hisso or J-5 and has been completely majored. No time since. Will license for one year. Have 201 American Eagle parts and brand new parts for J6-5 for sale cheap. Write for prices. Wanted: J6-9 in need of overhaul. T. E. Wear, Mt. Tabor, New Jersey.

OX-5 EAGLEROCK: Licensed to May 1938. 3 POLB. Very good. $365. LeRoy Airport, LeRoy New York.

### Fairchild

FAIRCHILD 22: Inverted Cirrus, built 1933; 15 hours since top overhaul. Compass, bank indicator. Rebuilt December 1935 from nose to tail. Beautiful high gloss finish. Relicensed to December 31, 1937. Price $1,395 for quick sale. F. P. Diliberto, 107 Park Street, Newton, Massachusetts.

FOR SALE: 5-place J-5 Fairchild. Pontoons and struts for above ship and for J-5 Waco. P. O. Box 308, Clearwater, Florida.

FAIRCHILD 24: Cirrus; just recovered, refinished, major overhauled, relicensed; perfect shape. Will sell or trade in cheaper ship. Aviation Supply Corporation, Municipal Airport, Atlanta, Georgia.

FAIRCHILD "24": Ranger; late 1935. Rate of climb, turn and bank, flaps, landing lights, radio, generator, pants, etc. $2,800. Air Service, Inc., New Castle, Delaware.

FAIRCHILD "22": 145 Warner; built April 1935. Turn and bank, rate of climb, landing lights, radio, generator; 120 hours total time, like new. $2,500. Air Service, Inc., New Castle, Delaware.

### Ford

FORD 4-AT-E: Powered with three J6-9's. Motors modernized. Full night flying equipment and blind flight instruments. Lux fire extinguisher system. Only 1375 hours total time on ship and motors. Motors regularly majored by approved agencies. $3,750. Ship is first class throughout and is a steal at this price. Price quoted is for quick sale. No trades. If interested, wire at once. Holland G. Bryan, Paducah, Kentucky.

### Fleet

FLEET: Model 7-B-5. Late type heads. Total time 660 hours; 130 hours since major overhaul. Ship recovered 1936. Licensed to January 1938. Starter and brakes. $1,400. Serv-Air, Inc., Box 1118, Raleigh, North Carolina.

FLEET, WARNER 125: Built 1929. Just relicensed. Excellent condition throughout. Has radio receiver, brakes, airwheels. $1,250. $625 down. Will take trades. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

### Great Lakes

FOR SALE: Great Lakes 2T1E, Cirrus Inverted motor. Steel prop, brakes. Ship and motor in excellent condition. $1,400. A. R. Ruth, 563 W. King St., York, Pennsylvania.

GREAT LAKES: Late type, upright motor, metal prop. Bank and turn, rate of climb. Licensed till February 1938. $1,175. AERO DIGEST, Box 2620.

GREAT LAKES 2T1A: Excellent condition. Privately owned. Original logs. Total time 875 hours. Hand-rubbed finish. Airwheels, navigation lights, airspeed, duals, baggage compartment. Engine just overhauled. Licensed to January 1938. Dale Perkins, Fort Wayne, Indiana.

GREAT LAKES 2T1A: Manufactured 1929. Just completely recovered and major overhauled. 40 hours on engine since major. Airwheels, military windshield. Absolutely perfect. $975. $487 down. Will take trades. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

GREAT LAKES 2T1A: Licensed; duals, brakes; motor needs little work. Bargain at $700. Can finance. AERO DIGEST, Box 2635.

### Kinner

KINNER LOW WING Sportster: 100 hp Kinner, recently majored. Hand-rubbed finish. Starter, brakes, duals, wired for lights; folding wing feature. Must sacrifice, $1,595. Leeward Flying Service, New Kensington, Pennsylvania.

### Laird

LAIRD WHIRLWIND: 3-place open cockpit, excellent condition, $1,750. Write for Used Plane List. E. M. Laird Airplane Company, 5917 S. Cicero Avenue, Chicago, Illinois.

LAIRD J6-9 330 HP: Fine ship for Government weather flights. Priced to sell. Terms. Michigan Aero Motors, Jackson, Michigan.

### Lincoln

LINCOLN PAGE: In good shape; motor just overhauled, OXX-6 with dual mags. Ready to fly anywhere. $350. Frank Fiese, North Platte, Nebraska.

### Lockheed

FOR SALE: The famous Miss Streamline of General Tire & Rubber Company, with all equipment, less radio. This ship licensed for 4750 lb. gross; has 5 wing tanks, 15 gallon oil capacity. Motor 150 hours since majored. General Tire & Rubber Company, Akron, Ohio.

### Loening

LOENING AIR YACHT: 8-place; just relicensed; new CE Cyclone, 4 hours total time. Very little time on salt water. In excellent condition. M. Madrazo, North Beach Airport, Jackson Heights, N. Y. Telephone: HAvemeyer 4-9600.

### Luscombe

LUSCOMBE: Warner Super Scarab; landing lights, radio receiver, engine driven generator. Purchased February 1937; 75 hours. Bargain. Warner Aircraft Corp., Detroit, Michigan.

### Monocoupe

FOR SALE: Velie Monocoupe, licensed until October 10th. Motor majored 25 hours ago. New Fahlin prop, new pyralin, cross bar landing gear. Price, $310. Robert Freed, Pender, Nebraska.

VELIE MONOCOUPE: In good condition, for cash, $390. Relicensed on May 1, 1937 to May, 1938. Robert P. Galebach, 1115 Lehman Street, Lebanon, Pennsylvania.

VELIE MONOCOUPE: Model 113, recently recovered; propeller just refinished; just relicensed; semi-airwheels; 521 hours total time. $500 cash. H. L. Grandy, Three Lakes, Wisconsin.

'31 WARNER MONOCOUPE: Licensed until April, 1938. Very clean, fast. Perfect condition. Never cracked. Cash bargain. Bob Hall, 2852 West 36th Avenue, Denver, Colorado.

MONOCOUPE: Velie 65 hp. Just majored; licensed to August 15, 1937. Fuselage and empennage recovered; all new windows; new control cable, new tires, ship and motor perfect. $450. Rock's Flying Service, Bristol, Vermont.

LAMBERT MONOCOUPE: Late '30; condition like new; motor just factory majored; electric starter, heater, pants, oleo gear, ring and many extra instruments. Will take best offer over $1,300; no trade. Murphy Flying Service, Kokomo, Ind.

LAMBERT MONOCOUPE: 1930. Factory rebuilt motor installed 100 hours ago. Ship completely refinished, high gloss red, black trim. Oleo and racing landing gears; oleo on ship. Pants, ring, battery, navigation lights, standard instruments. Privately owned and guaranteed perfect condition. $1,375. R. Nickerbocker, 563 South Lake, Aurora, Illinois.

MONOCOACH: J6-7-E engine; 4-place cabin; good condition. Excellent high altitude or small field plane. $1,350. 1935 Cub, A-40-3 engine, $800. Consider trades. Lytle, 2333 Vodeli Street, Pittsburgh, Pennsylvania.

VELIE MONOCOUPE: Finish, black and silver. Ship and motor perfect. Licensed to November 1937. Price, $450. Roy Rasmussen, 520 Second St., Devils Lake, North Dakota.

MONOCOUPE: Powered with Warner Super Scarab 145 motor. Time, less than 175 hours since new. Equipped for night flying. Bonded, shielded for radio. Radio receiver installed. Tunnel cowling. Very clean. Becker-Forner Flying Service, Inc., Jackson, Michigan.

LAMBERT MONOCOUPE: 335 hours total time; 73 hours on engine since major. Airplane recovered and finished in high lustre throughout. Special equipment: left door, engine cowling, wheel pants, tail wheel, special upholstering, clock: $1,800. Finance 50%. John T. Corrodi, Inc., Box 185, Bexley Station, Columbus, Ohio.

LAMBERT MONOCOUPE: Like new. 190 hours total time. Just overhauled, late type valves installed, two-band RCA radio, flaps, tail wheel. Priced right. Akron Airways, Airport, Akron, Ohio.

### Moth

GIPSY MOTH: Licensed to October. Repaintel last winter. 409 hours; 450 on engine, just top overhauled. $575. Providence Airport, Seekonk, Massachusetts.

MOTH, GIPSY: 100 hours since major on ship, 200 since major on motor. Cleanest Gipsy Moth in the country. $795. $395 down. Will take trades. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

### Pitcairn

PITCAIRN PA-6: J-5 engine with speed ring, starter, lights, etc. Engine recently majored, ship just gone over and licensed to 1938. Steal at $950. Kingston, N. Y., Airport. Don't write, come look at it.

J-5 PITCAIRN PA-5: Finished all yellow. New tires, starter, brakes. Wired for lights. Must sacrifice. $895. Can finance. Leeward Flying Service, New Kensington, Pennsylvania.

### Porterfield

PORTERFIELD: Late '35 model. Has brakes, speed and collector ring, air speed, tailwheel. 59 hours total on ship and engine. Absolutely perfect. $1,495. $750 down. Will take trades. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

PORTERFIELD: 1936 de luxe. New June first. Brakes, air speed, speed ring and pneumatic tail wheel. Position lights with 22-amp. battery. Total time 220 hours; 20 hours since factory major. Ship in perfect condition. $1,495. Pioneer turn and bank with venturi; no service since overhaul; $35. R. Gettelman, 4201 W. Martin Drive, Milwaukee, Wisc.

NEW DE LUXE Porterfield: LeBlond, brakes, speed ring, tail wheel, lights, special finish; $1,995. Edgar Smith, 3312 Olive, Kansas City, Missouri.

FOR SALE: Porterfield 1935; color black and international orange; LeBlond 70; total 206 hours. Perfect condition. Price, $1,200. Harry L. Clugeton, Macomb Airport, Macomb, Illinois.

### Rearwin

REARWIN SPORTSTER: $1,275. Desire to sell immediately. LeBlond 70. Has exhaust ring and carburetor heater. Both ship and motor in excellent condition. Thomas Metcalf, Transcontinental Airport, Toledo, Ohio.

REARWIN SPORTSTER: 90; brand new. Undelivered. Will trade automobile and finance balance. Can furnish ship as you specify. I. Walter Sell, 566 Vine Street, Johnstown, Pennsylvania.

REARWIN SPORTSTER: LeBlond 70. Brakes, speed ring, tail wheel, heater, Kollsman compass. Bought new at factory August 1936 by present owner and never once flown by any other person. Private flying for pleasure; no student instruction. 146 hours; never damaged; regular maintenance in Approved Repair Stations. Ship and motor in superior condition. Cash, $1,775. Captain W. W. Ford, ROTC, Fort Knox, Kentucky.

### Ryan

RYAN J-5 B-1: Just completely refinished. Complete set of instruments. Licensed for another year. For sale, or take in Taylor Cub '36 or '37 model on trade. Monroe Air Service, P. O. Box 582, Monroe, Louisiana.

RYAN STA: 125 hp Menasco, perfect condition throughout; less than 200 hours; no cracks, always hangared. Priced at $2,750 at Minneapolis. W. M. Miller, Cloquet, Minnesota.

RYAN B-5: Completely overhauled, recovered and reupholstered in late fall of '35; ship approximately 1200 hours. J6-9-D engine with approximately 450 hours. David J. Powers, Eagle, Wisc.

RYAN B-1: J-5. 5-place. Licensed to September '37. Good condition throughout. Steel propeller, airwheels, bank and turn, clock, tailwheel. 50 hours since major on engine. New upholstering. $975. $487 down. Will take trades. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

RYAN B-1: Excellent condition; must sell immediately; owner going abroad. No reasonable offer refused. John Herfurtner, 635 Sterling Place, Brooklyn, New York.

RYAN B-1: The ideal passenger-carrying airplane; night flying equioment; excellent condition; priced for immediate sale. Brayten Flying Service, Inc., Lambert-St. Louis Airport, Robertson, Mo.

### Savoia-Marchetti

SAVOIA-MARCHETTI: 5 hours since major; new bottom and sides; new tires, new covering; Heywood air starter, new pontoons. Just relicensed. Guarantee this ship to be in first class condition; no trades. Raymond V. Green, Fulton, New York.

SAVOIA MARCHETTI: Complete less engine. All parts in good condition and ready for covering. Will sell as is or any unit. Flying Dutchman Air Service, Somerton Airport, Philadelphia, Pa.

### Star

STAR CAVALIER: Lambert; licensed April 1938. Compass, airspeed. Ship and engine practically new condition. $850. Stevenson-Weeks Air Service, Municipal Airport, Kansas City, Missouri.

LAMBERT CAVALIER: Top overhaul, all new valves; new tires, windshields; licensed January; metal prop, blind instruments; as equipped, $800. Will give cash difference Fairchild 22, Fleet, similar ship. Bethel Brace, Box 661, Tulsa, Oklahoma.

### Stearman

FOR SALE: Stearman, Wright J-5 motor. Excellent condition, ready for immediate delivery. $1,200. Muncie Aviation Corporation, Muncie, Ind.

STEARMAN: Wasp Jr. Completely overhauled, new covering. Blind flying instruments, radio, transmitter, lights, speed ring. Many other extras. Aero-Ways, Inc., Cleveland Airport, Cleveland, O.

### Stinson

STINSON SM8A: Lycoming, 375 hours. Ship and motor in excellent condition. Forced to sell. License expires in September. $1,350. Fred Kleis, 301 W. Rockland St., Philadelphia, Pennsylvania.

STINSON R: New linen; turn bank, rate climb; nice shape; always hangared. $1,990. John A. Gurkin, 248 Bank Street, Norfolk, Virginia.

STINSON SR: Purchased from factory in October. 30 hours since major. Full set instruments. Retractable landing lights, flares, radio. Ship in perfect condition. Business reasons for selling. F. R. Alumbaugh, care Stockert Flying Service, South Bend, Indiana.

STINSON LYCOMING: Last S sold from factory. Best in country. 600 hours, 90 since major. Has forged pistons and transport shaft. Original finish, cannot be told from new. Is positively beautiful throughout. Ship always hangared, privately owned, never cracked. Is equipped RCA radio, and large 72-gallon tanks. Relicensed for year, will give new service without a dollar outlay. There are probably cheaper buys, but the few extra dollars invested will more than repay you. Lowest price, $2,150. Jones Auto and Airplane Sales, 640 Culver Road, Rochester, New York.

STINSON RELIANT 1934: Perfect condition, 375 total hours; 100 hours since Lycoming factory major. Radio, landing lights, flares. Privately owned. $3,600. AERO DIGEST, Box 2621.

$1,550: 8-A STINSON; majored; wings, tail recovered; donut tires; never cracked; privately owned. Consider diamond, car. J. E. Blythe, 1108 East Admiral, Tulsa, Oklahoma.

STINSON SM8A: Good serviceable condition. Balloon wheels, night equipment; rate of climb. Bargain, $1,175. Will accept trade-in. Carthage Airways, Carthage, Missouri.

STINSON JR.: '33 model De Luxe. Night flying equipment. Excellent condition throughout. $2,975. Will finance and take trades. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

STINSON T Trimotored Airliner: Beautiful condition. Motors have approximately 85-155-300 hours since major overhaul. Radio and night flying equipment. $2,450. Can finance and take trades. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

STINSON SM8A: Lycoming. Perfect condition; 777 hours; 8 hours since overhaul. Bank and turn, rate climb, landing and navigation lights, 60-gallon tanks. $1,500. H. W. Pugh, Municipal Airport, Burlington, Vermont.

STINSON SR-5-A: Lycoming 245 hp. Complete instruments, etc. Engine and plane just major overhauled and relicensed. Total time 1075 hours. A steal. Also, 1937 Stinson, practically new. This ship won't last long at this bargain price. Also, 1936 Jacobs Beechcraft, just like new. Write Aircraft Industries, Inc., Grand Central Air Terminal, Glendale, California.

1936 GULLWING SR-8B Stinsons: Have two ships, both de luxe equipped, with all night and blind flying instruments, large generators and latest RCA radio. Controllable propellers. One ship has 126 hours total with brand new motor installed 20 hours ago. Other ship has 6½ hours total, only having been factory test flown and ferried to St. Paul, Minnesota. Either ship will make an exceptional buy and may be had with or without special equipment, priced accordingly. Write or wire Flight Corporation, Wold-Chamberlain Airport, Minneapolis, Minnesota.

WRIGHT-POWERED Stinson Reliant SR-4: Built 1933, privately owned; total time plane and engine 460 hours; total time since complete overhaul, 125 hours. Wright J6-7 R-760-E 250 hp; 72-gallon gas tanks. Smith controllable pitch propeller; complete instruments, including bank and turn, rate of climb; RCA receiver, flares, landing lights; upholstered in red leather; licensed to December, 1937. $4,500. E. F. Knight, Bostwick-Braun Company, Toledo, Ohio.

STINSON "R": Engine only 50 hours since complete major, including new master rod bearing. Ship repainted red and black, new carpets, blind flying hood. Instruments just overhauled, and include bank and turn, rate of climb, sensitive altimeter, directional gyro, generator, landing lights, flares, 73-gallon gas tanks. Privately owned. $2,650. Eastern Aeronautical Corporation, Newark Metropolitan Airport, Newark, New Jersey.

STINSON SR-6: Smith controllable; special high-gloss finish on fuselage and wings; genuine leather upholstery; bonded and shielded for radio; landing lights, generator, Kollsman altimeter and compass, turn and bank, rate of climb, thermocouple. Low total time. This ship looks like new. A real buy. $4,995. AERO DIGEST, Box 2629.

1933 STINSON: Attractive blue and yellow color; night and blind flying equipment; a real bargain. Brayton Flying Service, Inc., Lambert-St. Louis Airport, Robertson, Missouri.

FOR SALE: Stinson R, equipped for night flying. Has flares and beacon receiver. $1,650. Also two 24-foot silk Russell parachutes. Both for $100. Blue Bird Air Service, Municipal Airport, Chicago, Ill.

STINSON R-3: Retractable landing gear and lights; specially built for Stinson executive. Full reclining, heavily upholstered seats, whipcord. Full set instruments, including thermocouple. Five Wiley flares. Big tanks. Fabric and interior excellent. Only 66 hours total ship time; 40 on Lycoming 240 since factory overhaul. One private owner. Just relicensed. $2,100; no trades. Fred Foote, 219 Lake Shore Drive, Chicago, Illinois.

STINSON: J6-9 330 hp, six-place cabin. Fabric excellent. Electric starter, new air wheels and brakes. Motor just majored. Will accept light car or airplane as part down payment. Balance financed. Central Air Service, Inc., Grand Rapids, Michigan.

STINSON 1934: Privately owned; just relicensed. Hamilton propeller, flaps, rate of climb, turn and bank, carburetor air temperature, manifold pressure, thermocouple, compass, clock, RCA radio, landing lights, flares, brand new cactus-proof tires, 75-gallon tanks, genuine leather upholstery; flown 325 hours; engine just majored; no time since. $3,500. Write owner care AERO DIGEST, Box 2638.

TRIMOTORED STINSON Airliner: Model T. Complete equipment; reasonable. Just licensed by the Department of Commerce. N. D. Butler, 1140 Twentieth St. N. W., Washington, D. C.

## *Travel Air*

J6-5 TRAVEL AIR: Total time 300 hours. First class condition. Licensed to May 15, 1938. Price, $1,500 cash. Emery Flyers, Inc., Bradford, Pa.

TRAVEL AIR 2000: New OX-5 motor. Turns 1400. New Dixie mag and radiator. Color white. Licensed to October 1937. OK in every respect. $350. Fred S. Dixon, 2127 Springfield Avenue, Norfolk, Virginia.

TRAVEL AIR: 6-place, J6-9-D 330 hp motor, just majored. Forged pistons, clutch, new bearings, rings. A-1 condition. Rubbed finish on fuselage. Fabric excellent. Licensed December 15th. Bank and turn, rate of climb, lights, starter, new tires. This plane ready for service; exceptionally good money maker. Price, $1,695. Terms, half down, balance twelve monthly payments. Norton Air Service, Inc., Norton Field, Columbus, Ohio.

OXX-6 2000: Scintillas. Just rebuilt; two new wings. Finished in red and silver. 500 hours on ship, 40 hours since major on motor. Bargain at $600. Write Archie Carr, Route 1, Brookville, Pennsylvania.

J-5 TRAVEL AIR B-4000: Ship just completely major overhauled and recovered. Absolutely perfect condition. 321 hours on motor since major. Just topped. One of last Travel Airs built. $1,295. $650 down. Will take trades. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

OXX-6 TRAVEL AIR: In good condition; licensed till September 15, 1937. Will trade for '34 or '35 car, terms, $425. Donald Carlson, Logan Field, Dundalk, Baltimore, Maryland.

J-5 TRAVEL AIR B-4000: Motor and ship excellent condition; oleo landing gear, bank and turn, rate of climb and clock. Privately owned. Price, $1,100. Doc Layton, Hangar 5, Floyd Bennett Field, Brooklyn, New York. Telephone: SOuth 8-0013.

TRAVEL AIR: All models available at Pioneer Aero Brokerage, Syracuse, New York. We buy, sell, brokerage, finance all type airplanes. Write for details on model you want.

TRAVEL AIR 2000: OXX-6; licensed. Recovered with Grade A "Flightex" last year by Fahlin Aircraft Co. Always hangared; A-1 condition; D-H wheels; Berry red fuselage trimmed black; wings silver. Hand rubbed finish. $550. Orvie Rasmussen, 508 N. Lyon, Marshall, Missouri.

WARNER TRAVEL AIR 4000: Perfect condition; less than 100 hours total time on engine. Just licensed. Best offer considered. Doug Peercy, Skiatook, Oklahoma.

OX-5 TRAVEL AIR 2000: Recovered 1935. Engine just majored. Millerized; compass; oversize tires. Stressed for J-5. Licensed to May 1938. Price, $500. Air Activities Airport, West Chicago, Illinois.

J6-5 TRAVEL AIR E-4000: Excellent condition. Engine brand new 300 hours ago. High gloss finish. RCA radio with vertical mast, turn and bank, air speed, brakes, clock, hand inertia starter. Gas capacity for 600 miles. Licensed to April, 1938. Selling to get larger ship. $1,250. Loren Jones, care of Emrick Flying Service, Central Airport, Camden, New Jersey.

## *Viking*

KITTY HAWK: Model B-4, Kinner K-5 side exhaust with collector ring. Completely rebuilt, engine majored. Just out of shops. $1,000. Will take J-5 engine as part payment. New England Aircraft School, Boston Airport, East Boston, Mass.

KITTY HAWK: Licensed to December. 639 hours on ship, 562 on 113 hp Siemens, now being majored. $950. Fenno Flying Service, Providence Airport, Seekonk, Massachusetts.

## *Waco*

WACO STANDARD S-6: Jacobs, battery ignition, (without flaps), licensed until March 1938. Cruises 133, top 150. Wood propeller. Color solid vermilion, blue leather upholstery. Extra equipment includes hand-rubbed high-gloss finish on wings and fuselage; airline type Lux fire extinguisher, connected with entire engine compartment and carburetor, also hand Lux and Pyrene; Crosley two-band beacon receiver with static-proof antennae; bank and turn, rate climb; three electric 1½ minute flares; retractable landing lights, position lights; tie down rings; lighted instrument panel, luminous dials; bonded, shielded; oversize tires. Licensed four people; can be licensed five people. Total time, 100 hours. Perfect mechanically and in appearance. Guaranteed never cracked up, scratched or even ground looped. Purchased new from factory April 1936; would cost new today about $7,000. Cash price, $4,747; will accept reasonable down payment from reliable operator, balance payable from income. Can be seen any time State Airport, Hillsgrove, R. I. Write Edward Bullard, Pomfret, Conn.

WACO 1934 CABIN: Wright. Complete night flying and instrument equipment. 400 hours total motor time. Relicensed until May 1938. Make an offer. L. H. Schaefer, Hangar F, Roosevelt Field, Mineola, New York.

WACO F-2: 165 Continental. Purchased new May 1932. Total time 450 hours. Licensed to April 1938. Always kept in hangar. Write Walter Wilcox, Greenfield, Massachusetts.

FOR SALE: 1932 Waco cabin, 210 Continental. Perfect condition. Warner Aristocrat, $750. Buhl Pup, good condition, $425. OX-5 Robin, $425. Jennings Bros., Worcester Airport, North Grafton, Massachusetts.

WACO OX-5: Newly covered, rebuilt throughout. Motor Millerized, only 80 hours. Ship like new, high gloss finish; licensed to November. William Zuorsky, care of Hulls Garage, Pittsfield, Mass.

WARNER WACO F: New linen, regular instruments; nice shape. Vermilion red, hand rubbed. $1,100. John A. Gurkin, 248 Bank Street, Norfolk, Virginia.

WACO F-5, JACOBS 225: Battery ignition, starter, generator; 195 hours on ship; 132 hours since motor was modernized at Jacobs factory. Vermilion color; hand rubbed finish; chromium plated wires. Instruments include rate of climb, bank and turn, and thermocouple. Ship is in perfect condition and like new in every detail. Price, $3,500 cash; no trades. Kenneth C. Holland, 6931 Stanford Avenue, Los Angeles, California.

WACO CUSTOM CABIN: 285 Wright and controllable prop; radio and instruments, special upholstery; color, black and white. Has had very little time and is priced to sell. Wings Field, Inc., Ambler, Pennsylvania.

WACO CUSTOM CABIN: 225 Jacobs, less than 200 hours. Ship in perfect condition and price is low. Wings Field, Inc., Ambler, Pennsylvania.

FOR SALE OR TRADE: Hisso Waco, 150 hp motor just topped and plane in good condition. Price $650. Will pay cash difference for good Warner Travel Air. Cleveland Air Service, Berea, Ohio.

WACO 10 GXE: 3 POLB. Needs right bottom wing, center section repair, prop and other incidentals. $175 to make room. Cecil C. MacDonald, R. D. 2, Turtle Creek, Pennsylvania.

WACO TAPERWING J-5: Recovered; special paint, hand-rubbed finish. Motor less than 100 hours total time. Speed ring, rate of climb, turn and bank, Heywood starter. Licensed until October. Perfect shape; $1,250. Bob Mooney, Fairfax Airport, Kansas City, Kansas.

WACO F: B-5 Kinner 125 hp. 3-place. Air wheels, tail wheel, starter, radio, landing lights, 32-gallon tanks. Reliable passenger job. $1,475. Harry H. Corley, 6628 Mack Avenue, Detroit, Michigan.

FOR SALE: J-5 Waco Straightwing seaplane. Ship, motor and floats excellent. Bargain. Russell Neff, 380 University Avenue, St. Paul, Minnesota.

FOR SALE: Waco GXE OX-5. Millerized, 75 hours since major. New prop and tires. Beautiful paint job. Eligible for license. Give away at $400. W. W. Watson, 513 Dogwood Street, Columbia, South Carolina.

WACO CABIN: 210 Continental. Landing lights, flares, turn-bank, rate of climb, red leather upholstery. Motor factory majored. Excellent condition throughout. Must sacrifice, $2,150. William Piper, Box 566, Clearfield, Pennsylvania.

WACO 9, OX-5: Millerized. 25 hours since majored. Covering excellent, duals, wired for lights; licensed till September. Perfect condition. Excellent time builder. Bargain, $300. Frank B. Buchholtz, Jr., 3102 W. Mt. Vernon Avenue, Milwaukee, Wisconsin.

WACO 10, OX-5: New motor and prop. Plane all new except cowling. Never cracked. Time, 70 hours. Licensed. L. M. Dunkle, Main Street, Chambersburg, Pennsylvania.

WACO 10, OXX-6: Motor 60 hours; Scintilla mags. Ship A-1 condition. Black, red stripe, silver wings. 25 x 11 x 4 Airwheels. $425. Bootz Frantz, 321 Bluemont Ave., Ghent, Roanoke, Virginia.

1934 WACO CABIN: 210 Continental with 25 hours since top overhaul. Many extras, including blind flight instruments, landing lights, flares, air brakes, two-way radio, generator, 70-gallon tanks. Licensed to June 1938. Price, $3,200. E. F. Ingals, 52 Cottage Street, Wellesley, Massachusetts.

WACO 10: Licensed until September. Only 14 hours since ship completely recovered, motor majored, new prop, new tires; not cracked. $400 for quick sale. Box 145, Hammond, Wisconsin.

WACO YKC: De luxe, 1934; Jacobs 225 motor, just modernized; total 220 hours. Radio, lights, flares, bank and turn, rate of climb, sensitive altimeter, clock and compass. Private owner. Aviation Service Co., Inc., Hartford, Connecticut.

WACO OX-5: Can't be told from new airplane; just rebuilt; recovered, repainted and modernized; engine completely majored, right down to a new prop; looks a million some come and see it at $480. Airport, Kingston, New York.

WACO F, K-5: Must sell, best cash offer. An economical, sweet flying ship. 750 hours total; 150 hours since overhaul. Near Chicago. AERO DIGEST, Box 2630.

WACO F: Kinner B-5, 125. Ship just relicensed. Bargain, $1,400. Will trade on Stinson 1931 or 1933 model. Clifford Hall, 158 S. Franklin Avenue, Mansfield, Ohio.

WACO 10, OX-5: Very good condition; ship now being completely gone over and recovered; beautiful finish, duals. Excellent buy, $425; or trade for good late model car. Earl Broadhead, 2502 Cass Street, LaCrosse, Wisconsin.

WACO 10, OX-5: New coverings, finish, windshields, upholstering both cockpits, propeller. Complete ship reconditioned, never cracked. Engine overhauled. Take late model car or best cash offer. Paul Miller, Gettysburg, Ohio.

WACO CABIN: Continental 1933; total time 378 hours; 30 hours since major overhaul; starter, air brakes, pants, dual wheels, etc., $2,400. Air Service, Inc., New Castle, Delaware.

WACO'S: All models available at Pioneer Aero Brokerage, Syracuse, New York. We buy, sell, brokerage, finance, all type airplanes. Write for details on model you want.

WACO "A": Late 1933 Jacobs; 20 hours since major. Bank and turn, Heywood starter, wheel pants, speed ring; yellow fuselage, green wings; excellent condition; $1,750. Finance 50%. John T. Corrodi, Inc., Box 185, Bexley Station, Columbus, Ohio.

WACO 10: Relicensed; $300 or trade for a car. John T. Corrodi, Inc., Box 185, Bexley Station, Columbus, Ohio.

WACO C: 1932 cabin; perfect condition throughout. Heywood starter; standard instruments; total time on airplane 815 hours; engine, 875; since overhaul, 20 hours. Finance 50%. $2,200. John T. Corrodi, Inc., Box 185, Bexley Station, Columbus, Ohio.

WACO GXE: OXX-6, Millerized, two Scintillas. Semi-airwheels; hand-rubbed fuselage, Stinson green, silver wings; licensed. Price reasonable. T. W. Cowart, 6420 Western Avenue, Washington, D. C.

WACO CABIN C: Late 1931. Continental 165. Steel propeller, air starter, rate of climb, bank and turn, sensitive altimeter, clock and Hill streamline pants. Always hangared and privately owned. $1,600, cash only. Can be seen at local airport. W. R. Cox, Box 755, Lexington, Kentucky.

WACO CUSTOM CABIN: 1935 model. 250 hours total time; completely reconditioned and modernized at Waco factory. Finished in high gloss Waco vermilion with black stripe. Has bonding and shielding, Lear radio compass, leather upholstery, turn and bank, rate of climb, thermocouple, landing lights, flares, 70-gallon tanks, pants and many other extras. This ship is priced to sell and will warrant your investigation. Mel Holbrook, State Airport, Hillsgrove, Rhode Island.

FOR SALE: WACO GXE OX-5, very late; exceptionally good. $475. Purdue University Airport, West Lafayette, Indiana. L. I. Aretz.

TWO OX WACO's: Model GXE in excellent flying condition, recently recovered, fabric perfect, 30 x 5 wheels, brand new Flottorp propeller. $200 down, balance financed. Central Air Service, Inc., Grand Rapids, Michigan.

1935 WACO Custom Cabin: Jacobs 225; 310 hours total time; lots of extras; $3,750. 1935 Waco Standard Cabin, Continental 210; 275 hours; $3,000. Waco F-3, Continental 210; like new; 210 hours; $3,250. Waco F-2, Continental 165; just rebuilt throughout; gloss finish, lots of extras; $2,100. These ships are all in excellent condition. Terms. Hardy Young, Municipal Airport, Oklahoma City, Oklahoma.

### *Welch*

WELCH: 2-place cabin; wheel control; 80 hours' time since new. Aeronca motor, NC licensed. Ship and motor A-1 condition. George F. Koeller, Jr., Mokena, Illinois.

### *Miscellaneous Aircraft*

OX-5 CHALLENGER: Just covered; perfect condition; $300. Cracked Aeronca, new motor; good shape; can be repaired; $150. Dr. J. E. Owen, 2½ N. Pack Sq., Asheville, N. C.

FLYING FLEA: First ever built in Ireland, first Irish flown in the world; first with elevators, beautifully upholstered, lovely machine. Ideal museum gift, or goldmine for flying demonstrator. $700 (approximately week's taking) f.o.b. $500 if museum gift behalf Erin. BM/NKRP, London, England.

SPORT TWO-PLACE: Side-by-side monoplane with 60 hp air-cooled motor. Just majored. New prop, airspeed, compass, dual controls. '33 model. $350 or trade. George Warner, 16th and Meeker, Muncie, Indiana.

STINSON GULL WING: 1936, 245 hp Lycoming, Standard steel controllable pitch prop; 168 hours total time; bargain. Monocoupe: 145 hp, little over 300 hours total time; always privately owned; never been cracked up; $2,400. Travel Air 4-place monoplane; J6-7 modernized motor; less than 750 hours total time; few hours since major overhaul; $1,600. Travel Air: Model 4000 Challenger biplane; motor and ship perfect; covering little over a year old. A bargain at $1,250. Cessna: Model C-34; 98 hours total time; in wonderful condition; $3,850. Cessna Aircraft Company, 5800 Franklin Road, Wichita, Kansas.

COMMAND-AIRE TRAINER 3C3: OX-5, with spare motor, just majored. Reed metal prop. Covering good; $390. Waco J6-5: Metal prop, air speed, rate of climb; modernized, excellent. All aluminum with red stripe. Red Bank Airport, Red Bank, New Jersey.

FOR SALE: Reliant De Luxe Stinson; SM8A Stinson; J6-5 Travel Air; J6-5 Robin; Buhl Pup; OX Waco; OX Eaglerock; OX American Eagle; OX Travel Air. Will trade. These ships are all licensed and ready to go. Burnham-Miller Flying Service, Municipal Airport, Omaha, Nebraska.

CHALLENGER ROBIN: LeBlond Klemm; Cubs, new and used, new Cub seaplanes; Fairchild 71 seaplane; J6-5 Robin seaplane; Porterfield. Lowest prices in the East. Terms to responsible parties. Airways, Inc., Waterville, Maine.

1936 PORTERFIELD: LeBlond 70; airwheels, brakes, ring, tailwheel, airspeed and compass; relicensed May 10th; always had best of care; looks and flies like new. No students, little time. OX-5 Travel Air: Perfect condition, motor recently overhauled, ship recovered; has semi-airwheels, brakes and usual instruments. Both ships must be seen and flown to be appreciated. No reaonable offer refused. Will deliver for expenses. Robert G. Hinkel, 811 N. 39th Street, Philadelphia, Pa.

FAIRCHILD PILGRIM FC-2: 5-place, 4 longeron, cabin monoplane, $1,000. C-3 Aeronca, motor just majored, just relicensed, $775. E-2 and J-2 Taylor Cubs, $800 and up. Travel Air biplane, Axelson factory rating 150 hp. powered, with extra motor, $1,000. Four-place J-5 cabin Monocoach, $1,200. Lycoming R-680, just majored; Continental A-40-3; Cirrus, Hisso, Kinner K-5, OX-5 and LeBlond 70 motors and parts. Russell 24-foot silk parachute and airplane parts for Robin, Cub, Ryan, Avian and Stinson Reliant airplanes. All planes and equipment sold for 25% down payment and balance financed by us. Pictures and information sent cheerfully. Aviation Finance Company, Hemlock, New York.

'33 AND '34 STINSON RELIANTS; '36 Lambert Monocoupe; '34 Lambert Monocoupe; 2-place Warner Fairchild; Bellanca Skyrocket; Rearwin Sportster, new, 85 LeBlond; 225 Jacobs Beechcraft; 420 Wright Beechcraft; Lockheed Vega; Lockheed Electra; Douglas Dolphin; 145 Luscombe; S-39 Sikorsky. Aircraft Sales Co., Hangar D, Roosevelt Field, Mineola, New York.

CAPRONI (Italian Moth): 2 POLB, DH Gipsy; just rebuilt and relicensed; new airwheels, oleos, prop, cover, paint; standard instruments plus compass, airspeed. Folding wings. $695. Lou Jacobson, 154 East 87th Street, New York, N. Y.

BARGAINS: Arrow Sport, excellent condition. Gee Bee, Model A, just licensed less than 300 hours. Motor parts for J-6, Challenger, Szekely, Axelson, OX and LeBlond. Inertia starters; wings for Eaglerock and Waco; accessories. Aviation Service Co., Inc., Hartford, Connecticut.

TRAVEL AIR 2000: Recently completely recovered; new wheels and tires; powered by OXX-6 engine; several extra instruments; cash price, $400. Waco 10, OX-5 engine: 200 hours since new; ship structurally good, fabric fair condition. Cash price, $400. Lancaster Municipal Airport, Jesse Jones, Lancaster, Pennsylvania.

RECONDITIONED USED PLANES: Stearman, Wasp Jr.; Waco F; Lincoln PT; Fledgling; Fleet; Stinson SR-6; OX-5 Waco, OX-5 Swallow. Aero-Ways, Inc., Cleveland Airport, Cleveland, Ohio.

GULLWING STINSON: Like new; built June 1936. 5-place; 150 hours. Extras: 70-gallon gas tanks, Hamilton controllable propeller, flares, landing lights, bonded and shielded, black fuselage trimmed in cream, black and cream wings. $5,700. 1933 Stinson: Radio, instruments, special upholstering, wonderful shape. $3,000. 1931 two-place Aeronca, good condition, $600. OX-5 Waco, $300. Meinke-Eldred Flying Service, Willoughby, Ohio.

TRADES, TERMS: Warner Cessna, LeBlond Davis, Siemens Waco, OX Waco, Butler Black Hawk. Alford Flying Service, LaGrange, Illinois.

FOR SALE: Waco Cabin Continental 210 hp, $1,700. Waco F, 125 hp Warner, $1,395. Travel Air J6-5, $1,200. Taylor Cub, $850. Aeronca C, $850. Newhouse Flying Service, Inc., Princeton Airport, Princeton, New Jersey.

VELIE COUPE: Good cover, semi-air wheels, brakes, navigation lights; price, $625. 1934 Aeronca E-113-C engine, just topped. Inter City Flying Service, Fort Wayne, Indiana.

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REPOSSESSED B-1 Ryan cabin ship, less motor. Price, $450. Repossessed J-5 6-place Stinson cabin ship, price, $550. Repossessed 330 hp Stinson, with or without motor; make offer with or without motor. Bargain prices. Edw. A. Forner, Jackson, Michigan.

FRANKLIN SPORT: $800. Kinner Bird, $1,300. 1935 Taylor Cub, $800. J6-7-E Monocoach, $1,200. J-5 Bellanca, $1,500. Curtiss Junior, $450. All ships licensed and in good condition. A. G. Becker, Pittsburgh-Bettis Airport, Dravosburg, Pa.

AIRPLANES: Motors, crack-ups, OX-5 ships, $90 up. Terms. Complete directory with full descriptions, owners price, name and address, 25c postpaid. Used Aircraft Directory, Athens, Ohio.

LAIRD SPEEDWING: Wasp C, 10:1 blower, electric starter, complete night flying equipment; cruising 150, top 180; price complete, $1,500; with skywriting equipment, $1,950; best skywriter in country. Speedwing Travel Air, with J6-7 or with J6-9, $1,550; with skywriting equipment, $1,950. J6-9-E engine, no time since major, $1,150. J6-7-D, $550. J6-9-D, $550. Laird Super Solution racer, less engine, $650; with J6-9-E, $1,825. Details on request. Mackey Flying Service, Findlay, Ohio.

FOR SALE OR EXCHANGE: Two Wright J6-9 Stinsons, 6-place. Two Driggs Skylarks, one nearly new; two J-5 Travel Airs; J-5 Waco; two OX-5 Wacos; Taylor Cub with enclosure. Can finance up to 60%. Automobiles or airplanes accepted in trade. Write for details. Central Air Service, Inc., Grand Rapids, Michigan.

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WANTED: Floats for Waco cabin, "F," Stinson, Fairchild 71 or any of these ships with floats. Max Marshall, Xenia, Ohio.

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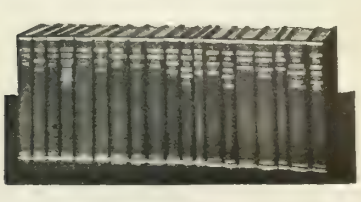
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**Control Surfaces:** Differential aileron control. Balanced control surfaces. Frise aileron. Auxiliary methods of lateral control. Formulas for control surface design. Special cases of rudder use.

**Performance:** Horsepower required curve for different altitudes. Landing speed Best gliding angle. Endurance and range. Corrections for speed and scale effects. Other methods of performance prediction. Characteristics of airplane that affect performance. Official tests.

**Dynamic Loads:** Accelerations occurring as a result of sudden change in angle of attack. Time histories of power-on and power-off pull-ups; of right and left barrel rolls and a right spin. Inverted flight. Landing and taking off.

**Materials and Construction:** Features governing design. Use of wood and metals. Retractable landing gear. Single wheel chassis. Oleo gears. Landing gear. Shock absorbing wheels. Brakes. Tail skid. Skis. Wings, fuselage, tail coverings.

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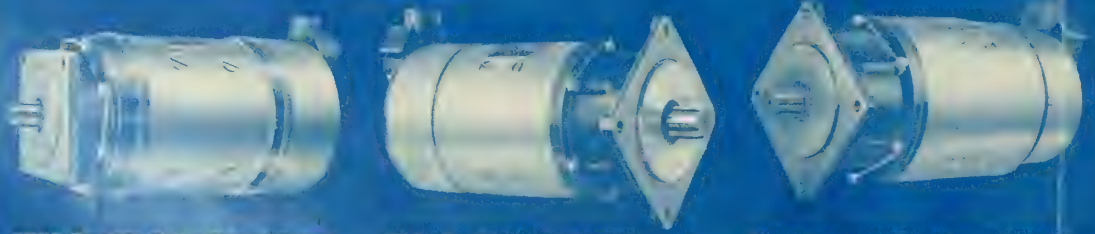
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